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April 1942

BIOLOGY and LAND USE

SOIL CONSERVATION

OFFICIAL ORGAN OF THE SOIL CONSERVATION SERVICE

Wildlife is in the war, too! With every inch of acreage drafted for production, Agriculture does well to consider the "extra" resources—the quail and rabbit and grouse of buffer strip and fence corner. This issue tells how to husband and encourage the vast farm wealth of fish and fowl and fur in gully and in field.

UNITED STATES DEPARTMENT OF AGRICULTURE – WASHINGTON

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EDITOR

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SOIL CONSERVATION

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TOTAL CONSERVATION

AN INTRODUCTION TO THIS ISSUE BY H. H. BENNETT

CHIEF, SOIL CONSERVATION SERVICE

There has always been one basic reason for soil conservation—the extent of its contribution to the welfare of mankind. Today that welfare depends on our success with respect to the prosecution of total war. It is not enough to conserve soil and water; soil conservation must result in the utmost yield, without waste of any kind, of those products of the soil needed by the United Nations.

Since the last war we have learned that we cannot achieve maximum production on all lands unless we fit our crops to the capabilities of the land itself. This is another way of saying that it is a waste of time and effort to try to produce a high-yielding crop on low-class land, or, conversely, that first-class land is being wasted if it is supporting only low-yielding crops. Recognition of land for what it is capable of producing is a prerequisite to good planning and management. By applying to the land this principle of use classification we can get the maximum out of our farmland, and each parcel of land will produce the most it is capable of producing, with a minimum of effort. Surveys of the use capabilities of American farmland, in several hundred localities well scattered over the United States, have revealed that we cannot be confident of long-time high production from our better lands unless we produce the crops with soil-conserving measures of lesser or greater intensity, as the case demands.

I want here to focus attention upon the total of approximately 33 million acres, included within the agricultural area of the country, that are clearly unfit for the production of cultivated crops, hay, pasture, or trees. This area is as large as the entire State of New York. We cannot afford to let this much land remain idle; nor can we waste fertilizer and effort trying to produce crops it is incapable of supporting.

Some of the land within these 33 million acres has been so gutted by erosion that even trees will not grow on it. Obviously, such land cannot be converted to woodland. Some of it is in critical positions where cultivation is out of the question and pasturing is unwise because of a high erosion hazard. The banks of streams, drainage ditches, and irrigation ditches, for in-

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stance, ordinarily cannot be farmed, even though they may amount to several acres of wasted land per mile, and to millions of acres in the aggregate. A great deal of marshland, incapable of being drained economically, occupies an appreciable total area, especially in the eastern United States. Finally there are the inevitable infertile spots and unproductive alkali areas commonly interspersed throughout good arable land.

Farmers know these infertile spots well. They include areas of shallow soil underlain by claypan, hardpan, rock, or gravel; small sharp breaks that cannot be farmed without damage to good land occupying lower levels; soggy spots that cannot be drained with any degree of practicability; salty lands that cannot be reclaimed economically; and many kinds of unusable rocky outcrops, sinkholes, and rough areas. Mostly small in size, these odd spots are worthless to agriculture, and any attempt to use them for crops is a waste of labor that ought to be devoted to more productive land.

These apparently worthless areas contribute their full share to the soil losses of the country. We suspect, in fact, that they may contribute more than their share, because many of them are extremely critical areas where erosion is more than usually active. Fortunately, however, it has been demonstrated that erosion on these wastelands can be controlled. The problem now is: How can they be made to produce a profitable crop with safety to the soil? As it happens, there is a crop that is especially adapted to the small areas scattered through better land—one that can be produced by simple treatment. The crop is wildlife. And the 33 million acres of so-called wasteland—because it cannot be more intensively used without waste—is properly designated as wildlife land.

In ordinary times considerable emphasis has been placed on methods designed to produce wildlife, in some instances almost as an end in itself. But these are extraordinary times; and, just as we demand the utmost of each man and factory, we must also require that wildlife resources play their full part. We must, of course, accompish this purpose without damaging our capital stock of wildlife or of wildlife land.

Already about 70 percent of the wild fur crop is produced on farmland. On the other hand, all the fur produced in the country in normal times is no more than the amount we imported in former years. Most of our imports came from countries now dominated by the Axis, and the disruption of shipping may shut off all or most of our imports. Furs are needed by our armed forces, by certain important industries, and of course by the civilian population. We must have furs, and it is logical to improve wildlife land in ways designed to encourage fur animals. Specialists studying fur animal production tell us that land capable of supporting muskrats—and this includes stream and ditch banks as well as marshland—can be made to produce three times the number of animals they do now. These specialists also remind us that the muskrat is the number-one fur animal in this country.

In the tens of thousands of farm ponds designed to control erosion and provide water for livestock, fish can be produced by the millions of pounds. This is a source of food given little consideration until recently. Fish provide food elements valuable in any diet, but especially

so in parts of the country where protein food is not as plentiful as it should be. Experiment station work in the South has developed means of producing 400 to 600 pounds of fish of good quality, such as bass and bream, per surface acre per year. At this rate one small pond of an acre or two can produce enough fish under modern management to supply a family of moderate size throughout the year. Since the production cost is 3 to 6 cents per pound, however, certain types of bottomlands probably should be re-appraised to determine where ponds should be developed.

In one way it is fortunate that wildlife land consists of small areas scattered through better classes of land: The vegetation used to protect them provides homes for enormous numbers of insect- and rodent-destroying birds and mammals. The resultant benefit to agriculture is of course obvious, and so much the greater because the wildlife land is so well distributed. Among the animals thus encouraged are game birds that can afford recreation that may be needed in the long pull ahead.

Wildlife can play its part in many other ways—but I am in no position to tell the biologists how to do their job. They tell me, however, that the productivity of wildlife land depends on proper use of all land, and that soil-conserving measures on all kinds of land are necessary for maximum production of wildlife. Here, I am on firmer ground, for I mean to do all that I can to see to it not only that wildlife land is put to good use, but that every kind of land produces the most possible with the least waste.

I often wonder if people really understand what total war means. Total war to me means utilizing efficiently and safely to its ultimate every resource we possess—labor, land, water, timber, minerals, wildlife, to say nothing of armed human resources. We Americans were terribly concerned a while back with the energy that was bound and idle when strikes were threatening our defense program. The strikers constituted only two and one-half percent of the men and women who were exerting their strength in similar work. More than three percent of American agricultural land is idle, wasted, and misused. This entails a dissipation in the amount of farm labor available for productive endeavors. Sensible management of wildlife land is fully as essential as management of any other kind of land. Let us then use all of our lands without waste, and require that they contribute their full share to the successful completion of the task upon us.

It is our earnest desire that all people understand that the agricultural conservation program does more than benefit the farmer through adjusting the production of crops to provide an abundance for domestic and export demands and in conserving our soils. The benefits extend to all industries supplying farmers with goods and to all who are interested in the maintenance and improvement of the soil, woodlands, streams and lakes, and of the living creatures of field and forest.—R. M. Evans.

FOOD FROM PONDS

By LAWRENCE V. COMPTON [1]

Total war to the Axis nations means utilization of every available resource. A specific instance involving fish production provides food for thought in this country. Resources in the United States are enormous, but they must be developed and utilized if they are to be totally effective.

ONLY a year ago the German Food Estate held a 2-day meeting in Berlin under the auspices of the Reich Union of Fisheries. The principal speaker was Dr. Roehler, Manager of the Union, who emphasized the importance from the point of view of fish culture of the new territories that had been incorporated in the Reich. It was estimated that through the addition of incorporated territories, the fishing grounds in Germany had been increased by 60,000 kilometers of streams, 100,000 hectares of lakes, and 40,000 hectares of drainable ponds. As a result thereof a sharp increase in fish production was expected.

This provides only an inkling of the importance that is placed upon inland fisheries by a nation in a time of all-out war. As a matter of fact, the growing of warm-water fishes, for both home and market, is an industry that has been practiced for many generations in Europe and is centuries old in the Orient. In Japan alone there are in excess of 100,000 establishments conducting fish culture in private waters, and the annual income from these ponds, lakes, and marshes is more than 3 million dollars. The ponds in the vicinity of Manila annually produce more than 3 million dollars worth of fish. Pond culture has reached an advanced state of scientific perfection in Europe, particularly in Germany and France. Not only does fish form a staple article of diet in all these countries, but the farmers regulate their seasonal production much in the manner that we do that of our fancy vegetables. Thus they are able to place their product on the market at seasons of demand such as at Lent, or at times when the production from natural waters is low.

These are countries of large populations, high land values, and intensive agriculture, yet it is in these that fish culture has reached its highest development. This is not due so much to an exceptional appetite for fish as it is to the fact that fish are an economical source of protein and that the raising of fish is a profitable use of the land. In these regions fish raising is often used as part of a crop rotation, with the field diked and flooded to form a pond. However, most of the fish culture is done in permanent, drainable ponds that are planned and managed for a maximum fish production. Even so, many of these ponds are used for stock water, boating, and swimming.

The farm pond offers the American farmer the opportunity to engage in fish culture and thereby increase the yield of his land, improve his family food supply, and augment his cash income. Relatively few farm endeavors offer so much in return for so little effort and investment. The main function of most farm ponds is the provision of a reliable source of stock water, but if properly built and managed, these ponds can be the source of many other benefits. Pan fish may be raised in them, and in an abundance. In some regions, ice may be cut and stored for summer use; in other regions the water from such ponds may be used to irrigate gardens. Everywhere, the farm pond is a useful tool in the control of erosion and floods, and in the regulation of stream flow.

Although the idea of using the farm pond as another field from which to harvest a food crop is not widespread in the United States, it is not an untried one. In the mountain States of the West many a rancher has for years been raising trout in his ponds for home and market. Some of these ranchers actually have gone into the resort business because their farm ponds were such good fish ponds. The propagation of bait fish, game fish, and gold fish has long been a profitable private industry in many parts of the country.

In recent years considerable effort has been made to gather records of pond productivity. Several artificial ponds in Illinois were found to have an average annual yield of more than 200 pounds of fish per acre. One of these ponds produced 377 pounds per acre. From natural ponds in Colorado, 100 pounds of fish per acre were taken annually by hook and line. A fish inventory of 17 ponds in Michigan, Illinois, Alabama, Louisiana, and Nova Scotia revealed that the average standing crop was 275 pounds per acre. These are productivity figures for unfertilized ponds; experimental evidence indicates that the productivity of a pond can be more than doubled with fertilization. In the South, an average, untended farm pond will produce

[1] Associate biologist, Southwestern Region, Soil Conservation Service, Albuquerque, N. Mex.

about 150 pounds of fish per year, but with fertilization such a pond will annually produce 400 or more pounds of fish.

Protein is essential to human welfare and it is desirable that a portion of the protein be of animal origin—eggs, milk, cheese, meat, or fish. It so happens that pond fish, such as bass, perch, and catfish, are higher in protein content than beef, pork, or mutton. A pasture of just average quality will produce annually approximately 150 pounds, live weight, of cattle or sheep. Fish production of nonfertilized ponds is approximately 200 pounds per acre. Cattle and sheep dress-out at approximately 55 percent of live weight; fish dress-out at 65 percent. Thus an acre of pasture may produce 85 pounds of beef or mutton and an acre of pond produce 130 pounds of dressed fish. If the pond is fertilized the production may be 260 pounds of clean fish.

Pond culture is, in reality, simple and inexpensive, but, like any other agricultural endeavor, it requires some attention and work. Nevertheless, pond fish can be produced with no more effort than is required by a vegetable garden. Building farm ponds and using them for fish production as well as other purposes will also provide the farmer a more abundant and interesting year-round occupation on his land.

FURS—A MILLION DOLLAR RESOURCE IN AN AGRICULTURAL STATE

By SYLVAN T. RUNKEL [1]

Enough fur to supply all our needs has not been produced in the United States since pioneer days. War has simultaneously expanded the demand and cut off our foreign supplies. Some 70 percent of the wild fur crop is trapped each year on farms, and simple management measures applied to the wildlife lands of agriculture could increase this figure substantially.

IOWA is primarily an agricultural State with 95 percent of the land in farms and only 3 percent in woodland, but its fur business yields to hunters and trappers almost a million dollars a year. The income was $718,330 in the 1935–36 season and $979,482 in 1940–41. Most of the trappers are farmers and farm boys.

In fur resources, Jones County is fairly representative of Iowa's 99 counties. It is significant that this highly specialized agricultural county produces from $8,000 to $10,000 a year in furs without the benefit of a game management plan and with only the protection offered by closed seasons. The accompanying table shows the kinds, numbers, and value of furs taken in Jones County during the winter trapping season of 1935–36, a season that is considered average. These data are from the records of the Iowa Conservation Commission.

Muskrat furs made up more than half of the return in Jones County, although marsh land is almost nonexistent. The majority of muskrats must have been trapped along streams running through farm land. This year the value of a muskrat pelt is about $1.60; if this price continues and the catch is average, the returns for the county in muskrat furs alone will be approximately $7,800.

[1] Associate soil conservationist, Upper Mississippi Region, Soil Conservation Service, Marion, Iowa.

Kind of animal	Pelts	Value per pelt	Total value
Racoon	160	$3.95	$632.00
Opossum	434	.32	138.88
Muskrat	4,902	.98	4,803.96
Mink	275	5.93	1,630.75
Skunk	602	.91	547.82
Civet	228	.31	70.68
Badger	1	5.12	5.12
Weasel	22	.55	12.10
Grey fox	8	2.00	16.00
Red fox	38	2.95	112.10
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No large-scale effort has been made to develop the county wildlife resource, but the Soil Conservation Service is assisting farmers and local and State agencies in developing complete farm plans including provisions for wildlife food, cover, and water, and protection of the valuable stream banks. A few State game management areas recently were established by farmers cooperating with the Conservation Commission and the Soil Conservation Service.

THIS ISSUE'S ARTISTS

Front Cover . . . . . *Katharine R. Johnson*
Center-Spread Layout . . . *B. M. Simmons*
Back Cover . . . . . *C. E. Margraff*

FENCE ROW FACTS

By CHARLES A. DAMBACH [1]

Fence rows can't be farmed, but they can be managed for the benefit of adjacent crops. Each 2 miles of clean fence row amounts to an acre of wasted land that could be used to improve biologic conditions on farmland. Simple ways to make these thin strips of land useful in agriculture form the substance of this article.

IN Indiana and Ohio there are approximately 750 rods of owned fences for each 100-acre farm. The average width of clean fence rows is about 4 feet; brushy fence rows and Osage orange hedges vary in width from 4 to 20 feet. If all fence rows on a farm are clean they occupy approximately one percent of the land; if all are brushy they occupy from two to four percent. Two miles of clean fence row equal an acre of land; a brushy fence row occupies from one and a half to four times this acreage.

Some farmers take pride in keeping their fence rows clean, the same sort of pride others have taken in straight furrows—even though they be up and down hill. Plowing with the property fence lines instead of with the land, has caused a considerable amount of erosion. Fence rows on the contour, permanently vegetated, become erosion buffer strips and contour guide lines that aid in retarding erosion; and, to appear neat, a fence need not be bare of vegetation. Fence rows of bluegrass sod or of low shrubs add much to the attractiveness of a farmstead. They also can be used to produce low-growing fruits and nuts such as blackberry, plum, cherry, hazel, and grape, and decorative plants as bittersweet, winterberry and Christmas trees.

In the agricultural sections of Ohio and Indiana, the amount and distribution of fence-row vegetation probably affects farm wildlife more than any other factor. There are many more birds on farms with woody fence rows than on similar farms lacking such cover. In Ohio, it was found that there were 32 times as many songbirds in shrubby fence rows as in open crop fields. Even clean fence rows of bluegrass supported nearly 7 times as many birds as open cropland.

Few of the insects found in fence rows are crop pests; most of them are harmless; and about a third are beneficial. For example, in Ohio there were 60 times as many aphid-eating lady beetles in Osage orange hedges and shrubby fence rows as in bluegrass cover. On many farms, permanent fence rows are the only places where beneficial insects, such as lady beetles, assassin bugs, and damsel bugs, can live undisturbed from year to year. The recommendations of entomologists to clean up fence rows as an insect control measure have been grossly misunderstood. Such control for specific pests is sometimes necessary, but not in all fence rows in all farming districts.

Mice abound in woody fence rows, but, fortunately, they usually are not the kinds that attack crops. Although meadow mice are abundant in heavily sodded grass borders, they do not find woody cover to their liking. However, woody cover provides homes for predators, as shrikes, sparrow hawks, skunks, and weasels that feed on rodents generally. Beneficial small mammals, like the short-tailed shrew and least shrew, live in fence rows as well as in crop fields.

Most of our common crop weeds are annual or biennial plants, but the perennial plants of permanent Ohio fence rows are not weed species. Annual and biennial plants stand little chance of becoming established under the shade of shrubs and trees or in fence rows of vigorous plants such as bluegrass.

Burning fence rows to control weeds, insects, or rodents usually fails to accomplish its purpose. By the time weeds are dry enough to burn, their seed have ripened and scattered, and their roots are too deep to be harmed. Few injurious insects are destroyed by burning and most entomologists have discontinued recommending this practice except for special purposes. Rodents in fence rows can easily escape from fires by remaining in underground runways or by moving into adjacent fields. Burning may do much harm; even a grass fire may be hot enough to melt the protective zinc coating on fence wire and metal posts, and to set fire to wooden posts. Fires also destroy beneficial insects and homes for insectivorous birds.

Fence rows are a necessary part of the farm pattern, but too often this part, small as it is, has been badly misused. Like every other acre, fence row acres should be put to their best use. We need to cast off old ideas about the fence row and manage it purposefully as an important element of the farm.

[1] Assistant chief, regional biology division, Ohio Valley Region, Soil Conservation Service, Dayton, Ohio.

Scientists estimate that in primitive times the dams of 60 million beavers held back flood waters in what is now the United States. Exploited for their valuable fur, beavers have been reduced to a very small fraction of their original numbers, but with the help of many conservation agencies, these animals are coming back.

BEAVER ON TRIAL

By PAUL M. SCHEFFER [1]

THE judge took his place at the bench. He spoke, "I find the defendant—not guilty!"

The true defendants of the case were not in court to hear their acquittal, but when word of the court's decision reached the wilds of the State of Oregon in the late evening, it might be imagined that the nocturnal silence of the wilderness exploded with the thunderous report of beaver tails slapping the dark waters in celebration. The beavers had been on trial and they had been set free!

This figuratively interpreted but actual court case was tried in Oregon in October 1939. Since then, requests have come from various parts of the country for full light on the probably unparalleled litigation involving the right of the flat-tails to live and work and enjoy their watery homes. Meanwhile, the beavers whose fate hung in the balance before the Oregon Court have thrived and multiplied—but that is a bit ahead of the story.

Actually, the right of a landowner to protect his land from the ravages of soil erosion with the assistance of a colony of beavers was subjected to court decision. The history of this unique case takes us back to the year 1884, when title to the land was acquired by a pioneer conservationist, C. W. Carey, through homestead from the Government. Carey sold the place to Paul C. Stewart in 1924, and Stewart later bought adjoining range lands. Part of this land was in meadow subirrigated by Crane Creek, a stream that coursed through flats of stirrup-high native grasses. Subirrigation was aided by several families of industrious beavers that had built numerous dams across the stream to form ponds for their homes. It was a productive ranch.

Forty years later, this picture suddenly changed. In 1924, Stewart left his farm for a year and, upon returning, found that poachers had trapped the beavers from his stream. The dams, no longer attended, had washed out. The unchecked stream ran wild. The washing out of the unattended beaver dams was not a remarkable phenomenon in itself, but more startling events followed in rapid order:

In 1925 flood waters raged through the meadow lands cutting into the nonstabilized stream channel, and erosion began.

By 1930 the stream channel had cut to a depth of 10 feet. Sloughing banks ate farther and farther into valuable crop land.

In 1935 the stream was flowing 15 feet below its original level. The water table in the adjoining meadows was dropping correspondingly.

[1] Assistant biologist, Pacific Northwest Region, Soil Conservation Service, Spokane, Wash.

By 1936 the valuable hay lands had been nearly destroyed.

One morning Paul Stewart stood at the edge of the stream gazing into a miniature canyon. It was a discouraging sight. Twenty feet below him, a small stream found its way around huge blocks of soil that had fallen from the banks. Only 11 years before, he had been able to drive his team across this waterway—protected then by beaver dams.

Stewart turned toward his meadow lands. More desolation. Dust, stirred by the hoofs of a few range cows, rose and settled over a near-barren waste broken only by clumps of encroaching sagebrush and sparse remnants of the original grasses. Other cattle stood at a tank, drinking the last water that a pump had been able to raise from the once abundant supply of the well.

Something had to be done! Engineering assistance was needed. Paul Stewart reasoned that if beavers had protected his land once, they could do it again. He sent an emergency call to the Oregon State Game Commission. Later that year, 1936, 16 of nature's best hydraulic engineers—the beavers—were placed on the farm at Stewart's request.

The beavers began their reclamation work at once. They erected strong dams almost overnight; they sent cottonwoods and aspen crashing into the gully; they built more and more dams. When the heavy spring run-off came, water that for the past 12 years had rushed through the stream channel to be lost in the river below was caught behind the beaver dams and held in large ponds. The ponds acted as settling basins for the silt-laden waters and at each flood stage inches of soil were added to the bottom of the deepened channel. As the ponds filled, excess water filtered through the dams and continued down the stream. The average summer stream-flow of the preceding 12 years was increased considerably by the water escaping from storage. Water from the ponds percolated into the edges of the adjacent fields. In only 2 years, the picture of desolation began to change. Hay production in the meadows increased. The well again supplied ample stock water. The ugly erosion scar through the meadow was healing.

Spring and summer rains in 1939 were not plentiful in Harney County, Oreg. The high range lands were not as green as they had been in previous years. Stockmen knew that their livestock would have to be brought in early in the fall to be fed from supplemental stores. Watersheds were unable to feed normal supplies of water to the lower lands. Irrigation water was at a premium.

Paul Stewart was fortunate. His beavers had been working night after night to impound a water supply that would keep his hay-meadows green and productive. The beaver ponds had raised the water table to the roots of the alfalfa and native grasses. Stewart's livestock would have plenty of feed for the winter.

Lloyd Johnson, neighboring rancher, living below the "reclaimed" Stewart ranch was not so fortunate. His meadows had drained into deeply gullied stream channels that were not protected by beaver dams. He would have to set his sickle bar pretty low to get even one cutting of hay this year. Sagebrush was invading his fields, too. What he needed was more water.

One day, while watching the trickle of water running through the gully in his meadow lands, Johnson decided to investigate. He knew of the beaver ponds on the Stewart ranch, and wondered what the water situation was on his neighbor's place. After a short walk along the creek, Johnson arrived at the lower outpost of the beaver stronghold. The sight that greeted him stopped him short—for he saw green native hay, fields of knee-deep alfalfa, and abundant water behind strong dams.

Johnson then decided that the salvation for his own crops, suffering from lack of water, was to drain the beaver ponds. If that were done then the water would flow on to his place. As shown later at the trial, Johnson did not foresee that little would be accomplished by draining the beaver ponds, or that the unchecked water would flow through his land to the river beyond. He discussed the matter with Stewart, who refused to dynamite the dams.

"Why," Stewart pointed out, "if those beaver dams were blown out, after the ponds had drained you wouldn't have any more water than you have now, and my ranch would go back to sagebrush."

The question remained whether Stewart had the legal right to impound more water than he had filed rights on, even though he was protecting his land. That, in effect, is what Johnson told officials when he obtained an order for Stewart to show cause why he should not release the beaver-impounded water. Johnson was in desperate need of water, and it was now a matter for court decision. The beavers were on the spot!

The case was brought to the circuit court in Harney County, and Stewart now becomes the actual defendant in the story. Johnson contended that Stewart was violating his decreed water rights. Stewart's counsel replied that the defendant was within his legal rights in protecting his property from the ravages of erosion by the use of beaver and beaver dams. "Furthermore," Stewart's attorney argued,

"as a result of the beaver operations, more water is now available to the plaintiff (Johnson) than the plaintiff has filed rights on."

The circuit court, in June 1939, ruled that Stewart had violated the court's earlier water-rights decree, granted Johnson a judgment for $500 damages, and ordered Stewart to have the State Game Commission remove the beavers from his property and to take their dams out of Crane Creek. Stewart also was ordered to pay a $300 contempt find and was given 5 days to comply with the court's order, subject to 3 months' imprisonment in the Harney County jail if he failed to do so.

The beavers had been given what amounted to their death sentence! The thousand years' work of their ancestors in helping to shape fertile valleys was unrecognized and their importance as flood-control and reclamation "engineers" had again been overlooked. But Paul Stewart, reluctant to accept as final the decision of his fellow man, appealed to the State supreme court. The appeal was granted and new hope was held for the beavers who were now to have a second chance.

The Oregon Supreme Court convened in October 1939 and the case of *State of Oregon ex rel. Lloyd L. Johnson* v. *Paul Stewart* was presented for argument. Although the beavers, the true defendants, were not present at their trial, they were ably represented by competent lawyers. Stewart's counsel began his argument:

"The question of soil erosion in this case," he stated, "is of national importance and the decision of this court will affect every erosion-control program in the Nation. This court must decide whether or not the landowner has the right to protect his chattel from destruction by erosion."

For more than an hour the court listened to his argument. "All my client wants," Stewart's counsel finally concluded, "is the right to protect his land!"

Johnson's attorney opposed the defending counsel with, "It is peculiar that the court should be listening to a soil-erosion case when it is not the true issue. Soil erosion is being used here as a subterfuge." Then he continued thus: "Mr. Stewart has retained water on his property that belongs to Mr. Johnson. Soil erosion wasn't even heard of when the water-rights decree was written. We are just now beginning to get erosion conscious."

Came time for the opinion of the higher court, the significant ruling that reversed the eviction order against the beaver along Crane Creek:

"After giving the matter our best consideration, we think that defendant would have the right to construct dams or permit them to be constructed by beavers to control the erosion, without diverting the water over the land or from the diversion works of another appropriator, and restore the bed of the stream to its original condition as near as may be, if he can do so without materially interfering with the right of the lower appropriator, Johnson."

Then the court added: "To deny our water users the right to control such streams and prevent the erosion that would soon take place would mean the utter destruction of much of our most valuable lands throughout the State. It is the duty of the landowner to prevent the construction of dams to a point where diversion from the channel will occur, but the landowner has the right to use or permit such dams for the purpose of erosion control, where they will not divert water from the channel or from the diversion works of another appropriator. It is shown that if the erosion is permitted to continue the water would be drained from the lands bordering on the creek and they would become dry and worthless."

Epilogue

Paul Stewart since has sold his ranch, but the beavers are still on the property and there has been a noticeable increase in the size of the colony.

"There are more than 150 beavers on the place now," Stewart reported, "and a number of large dams have been built in the creek channel running through the meadow and hay land. Most of the beaver dams are located above the cultivated land. You can see scores of them up there. The thing that pleased me most was the effect the beaver dams had on the water table of my cultivated lands. The level of the ground water was raised, and I got at least a 50-percent increase in my hay, grain, and alfalfa crops during the last 3 years I operated the place. Those beavers were worth plenty of money to me."

"I know that Johnson is getting more water now and for a longer season than he has for many years," Stewart observed in answer to a question. "I am sure the beavers had something to do with it. By now they should be down on his place too, if they have not been molested. You should see the creek channel on my old ranch now. Places that used to be 20 feet deep have silted up to within 3 or 4 feet of the top. Oh, there are still some spots where the channel is plenty deep, but the beavers are on the job and have it under control."

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SHRUBS BY DIRECT SEEDING

By VERNE E. DAVISON[1]

Planting nursery-grown shrubs takes a lot of labor, and labor is scarce these days. In the Southeast a way has been found to establish certain shrubs by direct seeding. The simple and inexpensive way to do it has been perfected during 4 years of field-scale trial.

SHRUBS are essential to the welfare of common kinds of farm wildlife. It is from the vantage of shrubby coverts that quail and pheasants forage through the fields, and perching birds capture insects over the crops. Shrubs are dependable havens from weather, predators, hunters, and farming operations. With this in view, problems arise as to suitable places for shrubs on ordinary farms, methods for establishing shrubs, and species to be used.

Shrubs belong on stream banks, in woodland borders, in fence rows, in windbreaks, in hedges, and over rock outcroppings and similar small areas that are not suitable for crops, pasture, hay, or woods. Agriculturists have not fully accepted this fact because simple methods of managing shrubs are not widely understood. Usually shrubs have been established by transplanting wildling or nursery grown stock. This is a cumbersome and expensive method that may be eliminated by direct seeding.

Among the woody plants most successfully grown by broadcasting or sowing the seed are the shrub lespedezas which have several promising features for farm use. They are easily kept in place because they do not spread by root suckers and do not seed into hay or grassland. Burning or cutting back to the ground does not kill them. The purple flowers produce honey, and quail eat the seed readily. *Lespedeza bicolor* is the species that has been used most widely; a second species, *Lespedeza cyrtobotrya*, appears to be equally promising for more northern conditions.

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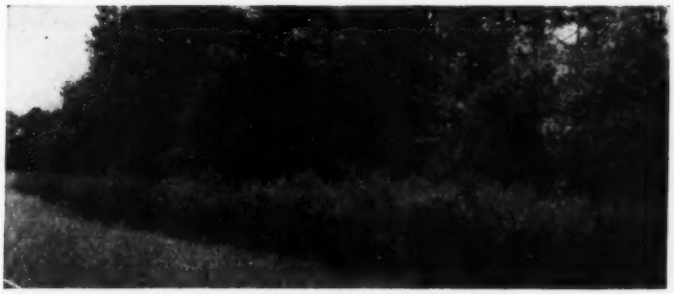
A serious problem of land management is always present in the Eastern States because the climate naturally favors woodlands—trees encroach on every acre that is not cultivated, mowed, or closely grazed. Shrubs, therefore, should be established in solid stands without open spaces into which trees will seed. The old style of planting shrubs 6 by 6 feet does not satisfy this requirement. Even 2 by 2 is not too close. However, 6 by 6 spacing requires 1,200 plants per acre; 2 by 2 takes almost 11,000; and $2 per thousand is about as cheaply as plants can be produced. The labor to plant so many seedlings is no small additional expense. Furthermore, plantings failed to give complete ground cover and erosion control. On the other hand, 8 or 10 pounds of seed per acre will produce more than 50,000 living plants of shrub lespedeza, more than 1 per square foot. In the Southeast considerable success has been attained in establishing 2 shrub lespedezas simply by sowing the seed.

To obtain sufficient seed for widespread use, a small seed production block of the two shrub lespedezas was set out in 1935 at the Soil Conservation Service nursery, Rock Hill, S. C. The plants had been grown in pots from seed the year before. Approximately 4 million seedlings were planted in Mississippi, Alabama, Georgia, South Carolina, North Carolina, and Virginia during 1937, 1938, 1939, and 1940. Survival was high and the plants bloomed and produced seed. It was evident that the direct seeding of shrubs offered the most promising means of establishing thick stands at reasonable cost, and nurserymen maintained that shrub lespedezas were more

A bird's-eye view of a well-managed field discloses the extent and neatness of a field border between the tilled crops and the woodland—a border that checks erosion, serves as a turn row for teams, and provides a place for wildlife.



Three-year-old **lespedeza bicolor** *from direct seeding forms an inexpensive border between crop field and woodland on a Florida farm.*

easily grown from seed than other shrubs. Sufficient seed was available from the 1937 harvest to test the dates and rates of seeding, also to determine the ability of the plants to survive without cultivation and in competition with annual grasses and weeds that volunteer following seedbed preparation. Consequently, in 1938 the seed blocks at Rock Hill were enlarged and new ones planted at Chapel Hill, N. C. and Sandy Level, Va.

Satisfactory stands survived and the tests were made again in 1939. In addition some 60 trials were made at different field locations widely scattered in the 7 Southeastern States. By the spring of 1940 there were 1,137 pounds of seed for field use and 487 separate seedings were made. The demonstrations in 1941 received 1,308 pounds of seed and accounted for an additional 160 acres on 500 farms. In the autumn of 1941 the 1938 plots reached third-year maturity, the 1939 trials showed promise after 2 years, and the 1940 demonstrations further proved dependable germination and first-year survival. This was conclusive evidence that direct seeding produced better results with shrub lespedezas than the planting of seedlings or transplanted stock.

The 1,146,000 plants grown in 1940 at Soil Conservation Service nurseries were withheld from erosion control plantings and the practice of using seedlings was abandoned. Instead, the shrub lespedezas were allotted to soil conservation districts for establishing local seed production blocks and a policy of direct seeding was established.

Shrub lespedezas may not be the answer to the problem of shrubs for farm wildlife, but they have demonstrated that direct seeding is possible. Time and continued effort is required to develop practical methods of seeding other species of shrubs, and such studies are being advanced together with further work on the shrub lespedezas. More important, however, is the proof that agriculturists are willing to accept shrubs in land-use patterns when the method of establishment is simple, direct, and economically feasible.

Seeding Specifications

To establish shrub lespedezas by direct seeding, broadcast 8 to 10 pounds per acre on a well-prepared seedbed, any time within 60 days after the last spring frost.

The plants may seem discouragingly small the first year, when they reach a height of no more than 3 to 12 inches. Growth the second year is ordinarily rapid after early August when the plants reach knee, waist, or even shoulder height before frost. Mature plants should be 6 to 10 feet tall in the third or fourth year.

To obtain tall plants during the first 2 years, sow in rows at 1½ to 2 pounds per acre, in rows 3 to 5 feet apart and cultivate. Moderate fertility is needed, particularly phosphate and, on sandy soils, potash.

Seed production in cultivated rows is negligible the first year; the second it should be 50 to 100 pounds per acre; the third year 150 to 200 pounds per acre can be expected. Selected strains and improved harvesting methods increase yields even beyond this figure.

Soil Conservation and the Biology Division are greatly indebted to Lawrence V. Compton, on detail to the Washington office from the Rio Grande-San Juan and Sangre de Cristo areas, New Mexico, for assistance in reviewing and organizing the material included in this issue.

Fish in the Dust Bowl

During 1941, as part of a program to utilize agricultural resources to a greater extent, thirteen soil conservation districts in the Southern Great Plains region obtained more than 50,000 fish from Federal and State hatcheries. With this supply they stocked 116 farm ponds.

GRASSES FOR SOIL AND WILDLIFE CONSERVATION

By EDWARD H. GRAHAM [1]

Grasses have always been of primary importance to man. That they provide first-class cover as well as food for wildlife is less well known. A summary account here points to many soil-conserving grasses that provide for wildlife welfare.

Grasses and Soil Conservation

IT IS not surprising that the grasses, so important to the farmer and his domestic livestock, should also be of great value to the soil conservationist and wildlife manager. As erosion-control plants the grasses form a dense, protective soil cover rivaled by few other types of vegetation. In the South, engineers find Bermuda grass sod highly effective for lining channels of waterways and terrace outlets in the water disposal systems that result from coordinated farm plans for conserving soil and moisture. In the southern Prairie States sloughgrass and prairie cordgrass are correspondingly adapted, and farther north Kentucky bluegrass and redtop serve the same purpose. In southern California an African importation, the spreading Kikuyu grass, is holding soil on outlet channel slopes exceeding 12 percent. In the Northwest, slender wheatgrass and seaside bent are similarly employed; while western wheatgrass and several bromes in the Great Plains, and vine mesquite in the Southwest, display the same useful characteristics.

American beachgrass, European beachgrass, and species of *Redfieldia* and *Calamovilfa* have long been valuable for controlling drifting sand. Sand bluestem is employed to hold blowing soil in the central Great Plains, and in the Dust Bowl cultivated grain sorghums are the first plants called into play to stabilize dunes caused by tilling crops on soils too light to support them permanently. In the West the Asiatic crested wheatgrass, western wheatgrass, the gramas, and other native species are much used for reseeding range lands. Giant wild-rye and Canada wild-rye are vigorously growing perennials used for erosion control in the Great Plains. Grasses are frequently planted with legumes to form soil-holding and soil-improving mixtures for forage in pastures, for cover crops in orchards, and for winter cover on crop fields. They are also used for field border plantings to control erosion between woodlands and crop fields, and for checking erosion on highway embankments.

Conservation practices involving use of grasses are known to exert a beneficial effect upon wildlife. Studies in the Southwest show that areas on which grazing was controlled for only 2 years supported a bird population approximately twice that of adjacent areas where grazing pressure by domestic stock remained unchanged. Likewise, in Ohio, the number of pairs of ground nesting birds in the meadow strips of strip-cropped fields has been shown to be about double the number existing in solid meadow fields of the same size under comparable conditions.

Grasses and Wildlife

More than 250 species of grasses in the United States, both native and cultivated, are known to provide food for nearly 300 kinds of wild mammals and birds. The accompanying table lists the 24 grasses most used for food by wildlife, according to records of the Section of Food Habits Research, United States Fish and Wildlife Service. Many game birds, as ring-necked pheasants, quails, and other gallinaceous species eat quantities of grass, both blade and seed. In the Southeast grasses are the first-ranking food of the mourning dove throughout most of the year; and in Arizona grass seeds rank second only to those of legumes as food for the Gambel quail.

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Grasses furnish about 15 percent of the yearly food of the California quail, and are so important to snow and blue geese during the winter stay of these birds in the Gulf Coast marshes of Louisiana that a management measure for their benefit is the burning of old dry vegetation to make young tender leaves available.

Grasses of wet places offer both cover and food for waterfowl. The shoal-water ducks make use of wild rice and barnyard grass, and eat quantities of cultivated corn, sorghum, barley, and rice. Rice cutgrass, bristlegrass, and mannagrass are also consumed by these birds, while saltgrass has value on the Pacific Coast. Grass seeds are eaten by many songbirds, among them the cardinal, whose food is three-fourths vegetable, chiefly seeds of weedy plants like bristlegrass, crabgrass, barnyard grass, and sandbur. One-third of the diets of Savanna, chipping, and field sparrows, and about half the food of the tree sparrow consists of grass seeds. Numerous rodents use grasses for food as well as for nesting materials, although many of them eat far more insects than commonly supposed. Hoofed mammals such as the antelope and buffalo are primarily grass feeders. Even deer and elk, though fundamentally browsing animals, consume considerable grass and other herbaceous vegetation.

Just as woodlands and shrubby thickets provide shelter and nesting sites for some animals, so grasslands and small grassy areas furnish habitat elements essential to the survival of others. Vesper, Savanna, and grasshopper sparrows, meadowlarks, horned larks, and bobolinks nest in grassy fields and meadows. Game birds such as the bobwhite, ring-necked pheasant, and prairie chicken prefer grassy spots for nesting, and migratory waterfowl depend in large measure upon such places. Other birds that nest in grass are avocets, willets, curlews, pipits and even some birds of prey, as the marsh hawk and short-eared owl. Many small mammals live in grassy areas and, although cover is usually considered to be concealing and protective, the bison and antelope find protection in grassland which although it does not conceal them at least reveals their enemies to them.

Cereal Grasses

The grasses that provide most food for man are also eaten most by wildlife. Corn is consumed by nearly 150 wild animals; no other plant is known to be eaten by so many species. Many game birds, as the ring-necked pheasant, mourning dove, bobwhite, and numerous kinds of ducks as well as mammals such as the raccoon, make extensive use of corn, so that farmers who wish to encourage wildlife frequently leave a few rows or shocks of this grain near patches of cover during the winter. Wheat is consumed by 120 kinds of wildlife and oats by 109. Barley, rice, rye, and millet are also eaten by a great many birds and numerous mammals.

Cultivated grain sorghums, of which there are many varieties, as milo, feterita, and Sudan grass, are food of more than 30 kinds of animals. Although not a cereal in the sense of being an edible grain, Johnson grass (*Sorghum halepense*), now gaining favor as an erosion-control and forage plant, furnishes good wildlife cover and is eaten by a dozen birds, including the bobwhite. The related native Indian grass (*Sorghastrum nutans*), however, is apparently not eaten by wildlife.

Panic Grasses

The group of grasses affording the greatest number of species useful to wildlife for food is the genus *Panicum*, which includes many grasses of high forage value. Most widely useful to wildlife is witchgrass (*Panicum capillare*), known to be eaten by 35 birds, including the bobwhite, scaled, valley, and Gambel quails, ring-necked pheasant, and several ducks. Fall panicum (*P. dichotomiflorum*) stands second; a dozen birds, among them bobwhite, mallard, and American pintail, make use of it. The creeping vine-mesquite (*P. obtusum*) of the Southwest, a stoloniferous soil-binding plant, provides food for wild ducks, and switchgrass (*P. virgatum*) is used by a half-dozen kinds of wildlife. Hall's panicum (*P. hallii*), although recorded from the stomachs of only four birds, is a favorite food of the Gambel quail and scaled quail; these birds also consume a great many seeds of Arizona panicum (*P. arizonicum*). Browntop millet (*P. fasciculatum*) and broomcorn millet or proso (*P. miliaceum*), popular for wildlife food patches, are eaten by 5 and 7 birds, respectively. Texas millet (*P. texanum*) is eaten by the mourning dove. A number of other eastern panic grasses provide valuable food for the bobwhite, and all in all, seeds of at least 40 kinds of *Panicum* are known to be eaten by more than 100 birds and 20 mammals. On the other hand, Guinea grass (*P. maximum*) and Para grass (*P. purpurascens*) appear useful for erosion control but have no recorded wildlife food value.

Paspalums

These grasses rank as a poor second to the panic grasses in their general usefulness to wildlife; 20 kinds are known to be eaten by 50 animals, most of which are birds. Bull paspalum (*Paspalum boscianum*) is eaten by 14 birds, notably the bobwhite, eastern

redwing, mallard, and pintail. A half-dozen other paspalums are important foods of the bobwhite, and the agronomically important Dallis grass (*P. dilatatum*) contributes to the sustenance of the bobwhite and lesser scaup duck. Vasey grass (*P. urvillei*), Bahia grass (*P. notatum*), and ribbed paspalum (*P. malacophyllum*), all of promise as forage and erosion-control plants, are not known to furnish food for wildlife.

Bluegrasses and Fescues

Like other pasture and range plants, bluegrasses aid in establishing a cover of vegetation that contributes immeasurably to the control of erosion. Although 50 kinds of wildlife are known to eat about half a dozen different kinds of bluegrasses, most of the records are nonspecific. Kentucky bluegrass (*Poa pratensis*), a valuable pasture plant, leads the list, with 8 animals known to eat it. Canada bluegrass (*P. canadensis*) is eaten by the muskrat and is of fair palatability to mule deer in California. Important range species include Sandberg bluegrass (*P. secunda*) of the Northwest, eaten by the mule deer; muttongrass (*P. fendleriana*), grazed by deer and elk as well as livestock; and Nevada bluegrass (*P. nevadensis*), of value to western big game. Although not so recorded, the highly nutritious bulblets of bulbous bluegrass (*P. bulbosa*) must be consumed by wildlife as they are by livestock.

Outstanding forage grasses are numbered among the fescues. A half-dozen kinds of wildlife eat six-weeks' fescue (*Festuca octoflora*), an annual of sterile soil throughout the United States, and as many animals utilize red fescue (*F. rubra*). Others are locally useful, such as meadow fescue (*F. elatior*), of value to mule deer in California; bluebunch fescue (*F. idahoensis*), eaten by mule deer and elk; sheep fescue (*F. ovina*), eaten by black duck and black-tailed deer; and Arizona fescue (*F. arizonica*), which is a valuable summer food for elk in Arizona.

Timothys and Bents

Timothy (*Phleum pratense*) is the foremost American hay grass, and its wildlife record is also good, for 20 kinds of birds are known to eat it. Alpine timothy (*P. alpinum*), of our western mountains, is consumed by mule deer, elk, and a few birds.

Very few of the bent grasses are used much by wildlife, although redtop (*Agrostis alba*), a standard pasture grass, is eaten by 4 animals, and unidentified members of the genus *Agrostis* provide food for 5 mammals and 15 birds, among which the ruffed grouse is conspicuous. Creeping bent (*A. palustris*) is known to be eaten by the New England cottontail and California mule deer. Colonial bent (*A. tenuis*) from which New Zealand, Rhode Island, and other agronomically important bents have been derived, is without known wildlife use.

Bromes and Bluestems

Brome grasses occupy an important place in meadow and pasture management, and a dozen species are known to provide food for about 35 birds and 15 mammals. Smooth brome (*Bromus inermis*) is considered highly palatable to elk; rescue grass (*B. catharticus*) is a food of the Arizona scaled quail; and nodding brome (*B. anomalous*) is eaten by the mule deer. Even the weedy soft chess (*B. mollis*) is valuable as food for the California quail, valley quail, and mule deer, and downy chess or cheat grass (*B. tectorum*) provides food for a few birds, among them the plumed quail. There is no record of wildlife utilization of true chess (*B. secalinus*), a useful hay grass in some sections.

Big and little bluestems were dominant components of the tall grass prairies, and are still abundant in some places; although they furnish ample cover, their use by wildlife for food is negligible. Perhaps the most valuable member of the group is bushy beardgrass (*Andropogon glomeratus*) an important beaver food in Texas; it is also eaten by the bobwhite, opossum and woodchuck. The abundant broomsedge (*A. virginicus*) of old fields in the Southeast is eaten occasionally by the bobwhite and sparingly by several other birds.

Ryegrasses, Wild-ryes, and Wheatgrasses

Italian ryegrass (*Lolium multiflorum*) is an important food of the California quail; seeds of darnel (*L. temulentum*) are also eaten by this quail as well as by the valley quail and a few other birds. Perennial ryegrass (*L. perenne*), of use to the soil conservationist as a cover and pasture plant, is very palatable to deer. Common rye, believed to be a genetic and mechanical mixture of Italian and perennial ryegrasses, has no reported use.

Wild-ryes are significant in western conservation operations, and they furnish food for eight kinds of wildlife. Both blue wild-rye (*Elymus glaucus*) and giant wild-rye (*E. condensatus*) are useful as food for elk and mule deer, although Canada wild-rye (*E. canadensis*) has no recorded wildlife food value.

Five kinds of wheatgrass are eaten by 15 kinds of wildlife. Slender wheatgrass (*Agropyron pauciflorum*) and western wheatgrass (*A. smithii*), both highly nutritious and palatable to livestock on the western

range, are the species of most value. The troublesome quackgrass (*A. repens*) has a negligible record of use by wildlife, and crested wheatgrass (*A. cristatum*) from Asia, so popular for range reseeding, is without records of utilization for food by American animals.

Bristlegrasses and Crabgrasses

Ranking high as food for wildlife, although essentially weedy plants, are the bristlegrasses or foxtails; 6 species are known to be eaten by 100 birds and about 10 mammals. Yellow bristlegrass (*Setaria lutescens*) has an unexcelled record for a noncultivated grass; its seeds are eaten by 4 mammals and 62 birds, including the Hungarian partridge, ring-necked pheasant, and several ducks. Green bristlegrass (*S. viridis*) is likewise valuable, for it provides food for 7 mammals and 49 birds, among which are the greater prairie chicken, Hungarian partridge, and mourning dove. Both of these grasses are also important foods of the bobwhite in the Southeast. Knotroot bristlegrass (*S. geniculata*) is an important bobwhite food plant; and foxtail millet, also called German or Italian millet (*S. italica*), is eaten by about 15 animals.

Although a weed, true crabgrass (*Digitaria sanguinalis*) supplies provender to 36 animals and is a useful food of the bobwhite. Smooth crabgrass (*D. ischaemum*) is likewise valuable to the bobwhite, as well as to 15 other kinds of wildlife. Other species are also significant, the crabgrasses being known to provide food for a total of 50 birds and several mammals.

Needlegrasses and Dropseeds

Although conspicuous elements of much of the western range, the needlegrasses do not furnish much food for wildlife, even though 20 animals are recorded to eat them. The seeds of green needlegrass (*Stipa viridula*) and needle-and-thread (*S. comata*) contribute sustenance to three animals, while Richardson needlegrass (*S. richardsonii*) is eaten by the mule deer and porcupine grass (*S. spartea*) by the elk.

There are a few records of wildlife utilization of the Western sand dropseed (*Sporobolus cryptandrus*), and of alkali sacaton (*S. airoides*), although more wild animals are known to eat seeds of eastern species, as *S. vaginiflorus*, *S. asper*, and *S. neglectus*, each consumed by three or more birds.

Gramas and Buffalo Grass

Soil-conserving range grasses include few more important than the gramas. As a group they are used considerably by wildlife, 30 animals being known to eat them, but important species of the genus, such as side-oats (*Bouteloua curtipendula*), Rothrock (*B. rothrockii*), and hairy (*B. hirsuta*) gramas, are apparently of little or no food value to wildlife, while black grama (*B. eriopoda*) is known to be eaten only by the prairie horned lark. Needle grama (*B. aristidoides*) and blue-grama (*B. gracilis*), however, are used by at least a half dozen animals each, blue grama being especially valuable to the Arizona scaled quail and Gambel quail.

Buffalo grass (*Buchloé dactyloides*), an important component of short grass range, is eaten by four birds, including the scaled quail, and is a preferred food of the pronghorn.

Other Grasses

Bermuda grass (*Cynodon dactylon*) has become highly valued in the South and Southwest as an erosion-control plant in pastures, for lining terrace outlets and diversion ditches, and for stabilizing gullies. Its seeds are eaten by 10 birds, including the mallard, pintail, and green-winged teal. Wild oats (*Avena fatua*) protectively clothes many California valleys and foothills to the near exclusion of other herbaceous plants; it is a European introduction used for food by 30 birds and several mammals. Carpet grass (*Axonopus compressus*), long a useful pasture plant of the Gulf Coast, is eaten by the bobwhite and Brewer's black bird. Seeds of several cordgrasses are food for wildlife, although the conspicuous member of the genus, prairie cordgrass or sloughgrass (*Spartina pectinata*), has a negligible record of usefulness. Reed canary grass (*Phalaris arundinacea*) is eaten by ruffed grouse and green-winged teal, and orchard grass (*Dactylis glomerata*) by several animals. Seeds of the introduced Egyptain grass (*Dactyloctenium aegyptium*) are consumed by 8 birds, including the bobwhite, and are considered an important food of the mourning dove in the Southeast.

The genus *Hilaria* includes several grasses useful to the range manager, such as curly mesquite, galleta and tobosa, but records of wildlife use are few. Another useful range plant is June grass (*Koeleria cristata*), eaten by the mallard, mule deer, black-tailed deer, and elk. Indian ricegrass (*Oryzopsis hymenoides*) is one of the best desert range species; it, along with a few other species of the genus, furnishes food for 8 birds and a half-dozen mammals. Foxtail barley (*Hordeum jubatum*), a conspicuous weed of the West, is eaten by several birds and a few mammals, as muskrat, deer, elk, and antelope, but the barbed awns cause injury and infection to the mouths of grazing animals and make it a serious pest of livestock and big game.

(*Continued on p. 250*)

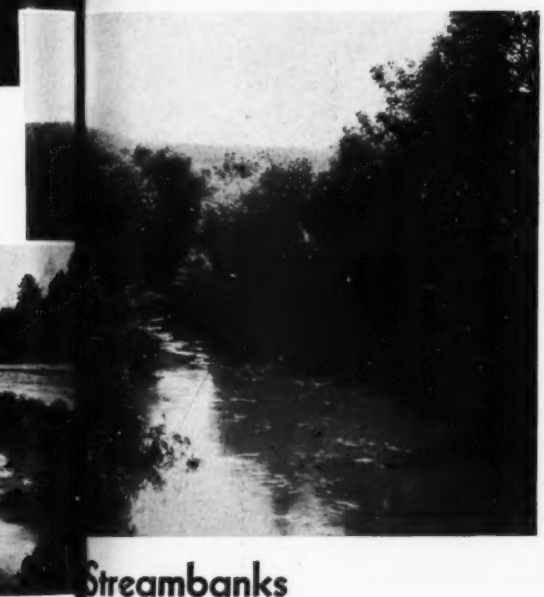
Wildlife Land

On all American farms are lands that are wholly unsuited for cultivated crops, hay, pasture, or woodland. These lands include such places as field borders, odd infertile spots, streambanks, severely eroded areas, ditchbanks, and marshland—

Field borders

Odd infertile spots

Severely eroded areas



Streambanks

Ditchbanks

Marshlands

—All told, 33 million acres of American farmland are suitable only for the production of wildlife. Efforts to make them productive of something else are largely wasted. Used for wildlife they benefit agriculture.

(Continued from p. 247)

A plant valuable to wildlife, although weedy, is the common barnyard grass (*Echinochloa crusgalli*), known to be eaten by more than 50 animals. It is especially important to waterfowl and upland game birds. Japanese millet, advertised as a wildlife food plant, is a variety of barnyard grass. The three-awns are common grasses in some parts, but only 3 species furnish food for wildlife; the most used is arrow feather (*Aristida purpurascens*), seeds of which are eaten by the bobwhite, scaled and Gambel quails. Even the spiny-fruited sandburs provide food for a half dozen animals. That rodents may be beneficial by virtue of their food habits is shown by the fact that the cheek-pouches of a spotted ground squirrel were found filled with the seeds of the troublesome dune sandbur (*Cenchrus tribuloides*).

Dune grasses, on the whole, are little used by wildlife for food, but grasses of moist places are utilized to an exceptional extent. As food for wild ducks, the wildrice (*Zizania aquatica*) of lake and pond margins is probably the outstanding grass, for it is eaten by 30 birds, including blue-winged and green-winged teals, lesser and great scaup ducks, canvasback, ring-necked duck, redhead, mallard, black duck, baldpate, wood-duck, and pintail. The closely related Southern wildrice (*Zizaniopsis miliacea*), although used by several birds, spreads on shallow silt flats to such an extent that it presents a weed problem. Rice cutgrass (*Leersia oryzoides*) is another wet-land plant eaten by 15 birds, and saltgrass (*Distichlis spicata*) of alkali meadows is of value as food for 31 birds, many of which are waterfowl. The widespread bluejoint (*Calamagrostis canadensis*) of moist areas is palatable to mule deer and elk and much eaten by muskrat in Ohio; its seeds are relished by a few birds. Mannagrass (*Glyceria striata*) should also be listed with the good wildfowl foods. The common reed (*Phragmites communis*), so abundant in wet places throughout the country, is a staple food of muskrat in Louisiana.

A few well-known grasses, conspicuous because of their size, that have no recorded wildlife food value are sugar cane (*Saccharum officinarum*); giant reed (*Arundo donax*); southern cane (*Arundinaria gigantea*) of the southeastern canebrakes; its lesser relative small cane (*A. tecta*); and the ornamental South American pampas grass (*Cortaderia selloana*), being used experimentally as an erosion-control plant. The fact that seeds appearing to be useful to wildlife may not necessarily have such value is illustrated by the large white seeds of Job's tears (*Coix lacryma-jobi*), which are not known to be eaten by any animal. A number of other grasses, many recently introduced for trial as erosion-control plants, have as yet no known wildlife usefulness. Perhaps we shall learn of their value to wildlife as we are learning of their contribution to erosion-control. Among them are Asiatic centipede grass (*Eremochloa ophiuroides*), a lawn and pasture plant for the South; Rhodes grass (*Chloris gayana*) an African introduction for southern Great Plains pasture; Kikuyu grass (*Pennisetum clandestinum*), of use on water disposal systems in California; and lovegrass (*Eragrostis curvula*).

Twenty-four Grasses Most Used by Wildlife for Food

[Compiled from records of the Fish and Wildlife Service]

Common name	Scientific name	Birds	Mammals	Total
Corn	*Zea mays*	127	19	146
Wheat	*Triticum aestivum**	110	10	120
Oats	*Avena sativa**	96	13	109
Yellow bristlegrass	*Setaria lutescens**	62	4	66
Barley	*Hordeum vulgare**	58	6	64
Green bristlegrass	*Setaria viridis**	49	7	56
Barnyard grass	*Echinochloa crusgalli*	50	4	54
Rice	*Oryza sativa**	40	....	40
Wild oats	*Avena fatua**	34	2	36
Crabgrass	*Digitaria sanguinalis**	34	2	36
Witchgrass	*Panicum capillare*	34	1	35
Seashore saltgrass	*Distichlis spicata*	31	....	31
Sorghum	*Sorghum vulgare**	30	2	32
Annual wildrice	*Zizania aquatica*	30	....	30
Smooth crabgrass	*Digitaria ischaemum**	15	1	16
Rye	*Secale cereale**	15	1	16
Rice cutgrass	*Leersia oryzoides*	14	1	15
Italian millet	*Setaria italica**	14	1	15
Southern wildrice	*Zizaniopsis milicea*	14	....	14
Bull paspalum	*Paspalum boscianum*	14	....	14
Fall panicum	*Panicum dichotomiflorum.*	13	....	13
Johnson grass	*Sorghum halepense**	11	....	11
Bermuda grass	*Cynodon dactylon**	10	....	10
Slender crabgrass	*Digitaria filiformis*	9	....	9

*Introduced species.

Bees, Legumes, and Conservation

By extending the acreage of legumes used by bees, programs of soil conservation and agricultural adjustment aid beekeepers. Conversely, beekeepers contribute to such agricultural programs—the 1942 goal for seed production of leguminous crops, set at 415,000 acres, will be realized in no small part because of pollination by honey bees.

ADOLPH LEE LOOKED AHEAD

By WALLACE L. ANDERSON [1]

A simple story of the benefits to wildlife on a Wisconsin farm where soil-conservation methods are in use.

ADOLPH LEE might be called a "rugged individualist." Twenty years ago he did something nobody else in his neighborhood had ever done—he planted willows along the meandering stream that cuts diagonally across his steeply rolling farm of 144 acres in Vernon County, Wis. In 1941 Adolph Lee was cropping areas that 10 years before were part of the stream, while on neighboring farms the same stream was still barren of cover and still cutting its banks.

Back in 1934 Adolph had "joined the erosion"—cooperated with the Soil Erosion Service—and in 1940 he "joined up" with the Coon Creek Soil Conservation District, now the Vernon County Soil Conservation District. His farm plan included maintenance of his protected stream, protection of steep woodlands from fire and grazing, pasture improvement, and contour strip cropping with rotations having a high percentage of alfalfa.

Comparison of information obtained by Soil Conservation Service technicians in 1940 with that obtained by a previous survey in 1935 indicates that 5 years of conservation farming have had a significant influence on the wildlife of Adolph Lee's farm. There was an 11-percent increase in the number of nesting birds and a 20-percent increase in the number of species of birds living on the farm. The presence of woodcock in 1940 in one of the formerly pastured woodlands indicates how 5 years of protection had transformed this area from one of hard, dry soil compacted by the hoofs of cattle to one of moist, mellow soil protected by forest litter and porous enough to let a "timberdoodle" probe for his favorite earthworms.

The 1935 survey showed but one brood of ruffed grouse, no bobwhite quail, and no ring-necked pheasants. In 1940 there were two broods of grouse, four of quail, and two of ring-necked pheasants. The surveys confirmed the fact that willows are not the best nesting cover for birds along streams. Boxelder, with its denser growth, contained three times as many nests as willows even though the latter were more abundant. Forty-three percent of all the birds nesting on the farm were found along the narrow stream and in fence rows, which together occupy less than 4 percent of the total farm area. Another 32 percent of the nesting birds were found in woodlands and orchard. The remainder were in cropland, pasture, and the farm yard.

Adolph Lee is an enthusiastic sportsman who appreciates game birds and animals, but as a farmer, he says: "I need song birds too, for they help me grow better crops by keeping insects in check. I'd rather have my streambanks doing a good job of controlling erosion and producing birds than a poor job of supplying pasture. I hope we can have still more birds on the farm."

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SOIL CONSERVATION FAVORS BOBWHITE

By VERNE E. DAVISON [1]

Land-use practices designed to conserve soil and moisture provide food for the bobwhite, as revealed by studies in the Southeast. An increased supply of quail—most valued game bird of the South—is shown to be closely correlated with soil and water conservation operations.

ON THE general run of farms in the Southeast the provision of adequate food and its interspersion with cover are the most important contributions to the establishment of desirable habitat for the bobwhite quail. A study of the crops of 5,889 bobwhites taken in the Southeastern States shows that a soil-conservation program provides the foods essential to the survival and increase of this bird. With erosion-control practices creating new patterns of permanent land use it can be expected that the bobwhite population will increase.

The study revealed that seeds of common and Korean lespedezas are eaten more generally than those of any other plants. Similarly, Kobe lespedeza, cowpeas, soy-

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beans, partridge-peas, Florida beggarweed, and peanuts are dependable foods where they can be supplied in sufficient quantity. Only one is needed—not all of them. With the exception of partridge-peas and Florida beggarweed, these are field crops useful in crop rotations. Strip cropping with these legumes furnishes an abundance of seed every year. Without strip cropping, food may be abundant one year and absent the next.

Acorns rival the annual lespedezas as food for the bobwhite and they are supplied in sufficient quantity in most ungrazed woodlands. The seeds of sweetgum, the fruits of flowering dogwood and blackgum, and occasionally pine mast also are important woodland foods. Plants that are principally valuable for shelter but are frequently taken for food include Japanese honeysuckle, sumac, black cherry, poison-ivy, sparkleberry, and grape. These plants are naturally abundant in woodland borders, hedges, and small shrub areas.

Several annual and perennial herbs, although relatively unimportant on the average farm, also supply food in varying amounts. They flourish on burned or idle areas. The more important are perennial beggarweeds, partridge-peas, milkpeas, tickclovers, wild beans, groundnut, and butterfly-pea.

Wild vetches are important in spring and early summer, and *Lespedeza sericea* may prove to be particularly valuable when snow covers other food plants. Sericea lespedeza is becoming recognized as the most dependable plant for field borders where it serves primarily as a shelter for both soil and wildlife. Waste grains of corn, wheat, and sorghums, together with the ragweeds, bull grass, insects, and greens of the field complete the important items of diet for the bobwhite on the average farm.

A soil-conservation plan including uncut sericea field borders, shrubby woodland borders, protected stream banks, hedges, and small shrub areas, should improve and assure adequate food for bobwhites on farms that have strip-crop rotations, woodland management (including controlled burning when desired and protection from grazing), improved pastures, protected crop residues, and perennial hay supplies. Thus, a soil-conservation plan favors the proper distribution of shelter among those foods known to be particularly useful to the bobwhite quail, and so may contribute materially to the increase of this desirable bird.

TEN YEARS OF PROTECTION

By CHARLES A. DAMBACH[1]

A cardinal principle of soil conservation is the protection of woodlands from destructive fire and grazing. In an Ohio farm woods this resulted in an increased volume of timber, greater yields of maple sugar, a mellowing and enriching of the soil, and excellent reproduction of valuable trees. Significantly, the insect-destroying birds were found to be four times as numerous as in adjacent mistreated woodlands.

IN APRIL 1931, 2 men working 3 days used 180 rods of salvaged barbed wire, 59 posts cut from disease-killed chestnut trees, and 2 pounds of staples to build a fence along the pasture side of the Kibler woods in New England-like Geauga County, Ohio. The ensuing 10 years' relief from trampling hoofs and munching jaws worked wonders on the 7.9 acres of maple grove protected by the new fence. It is easy to see what protection has done for this woods. Adjoining it and separated from it only by a fence, is a similar maple grove; similar, that is, in that it is on a comparable site, and has the same proportion and size of tree species; but dissimilar in that continued grazing has brought about many changes.

The most obvious difference between these woods is the abundance of natural tree reproduction on the protected side and the near absence of reproduction on the grazed side of the fence. Sample plots indicated that in 1941 there were approximately 53,000 young trees per acre, ranging in height from 6 inches to 21 feet, in the protected lot; whereas there were fewer than 1,000 seedlings per acre, 5 inches or less in height, in the grazed tract. Of the young trees 98 percent are sugar maples, the preferred tree in this maple sirup-producing section. Many tulip poplar, white ash, cucumber magnolia, red and white oak, and wild black cherry are also present. Because he knows his woods intimately, F. E. Kibler is able to point pridefully, in the protected woods which he owns, to individual trees that he has watched grow from tiny seedlings

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to a height of 18 to 21 feet within 8 to 10 years.

To one accustomed to visiting each mature maple many times a year, to tap, hang buckets, and gather sap, another difference in the woods is evident. The soil, which 10 years ago was hard packed around the base of each tree, exposing the shallow roots, is becoming mellow and soft. The roots are nearly all covered with a thick layer of leaves that once were scattered by the wind and blown into the draws where they did little good. This observation is supported by checks of soil compaction and litter depth in both woods. A study of frost penetration records adds further proof: Measurements made on February 14, 1941, after an extended cold snap with a low of —16° F. showed that in the grazed woods frost had penetrated 2 to 6 inches. In the protected woods the soil was loose and moist beneath the protective mantle of leaves. The difference was not entirely due to the leaves, however, as the protected woods was covered with a uniform blanket of snow 8 to 12 inches deep. Across the fence, the snow was deep only at the east end, where it had been blown by the wind.

An early morning visit to these woods late in May, when birds are particularly evident by their singing, would demonstrate the effect of woods protection upon wildlife populations. The songs of birds would be noticed to come much more frequently and in greater variety from the protected woods than from the grazed tract which is twice its size. A census of nesting birds, conducted through 4 seasons, showed that in the protected woods there were 19 species of song birds and a yearly average of 1.7 pairs per acre.

A close view accentuates the contrast between the woodlot with ten years' protection and the woods that is still grazed across the fence.

In the grazed woods there were only 8 species and 0.4 pair per acre per year. In other words, the protected woods were being policed by 4 times as many insect-eating birds as benefited the grazed woods.

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DOES KUDZU HAVE WILDLIFE VALUE?

By VERNE E. DAVISON [1]

KUDZU, first used as a porch vine in the Southeast, has become a stalwart ally in the control of erosion in gullies and on severely eroded slopes. In the Southeast, during the past few years, thousands of acres have been planted with kudzu for soil-conservation purposes. The value of this plant for hay and grazing is becoming apparent, and its permanence in southern agriculture seems assured by its successful use for soil improvement in crop rotations.

Little is known concerning the value of kudzu for farm wildlife. Rabbits use it, eating the leaves during the growing season and the bark in the winter. In fact, more than once has a concentration of rabbits been known to destroy in a few weeks small areas of newly planted kudzu adjacent to good rabbit habitat. T. W. Edwards, of Wilkesboro, N. C., "used kudzu as the sole roughage for about a dozen tame rabbits during one summer and found it to be very satisfactory either green or cured. The rabbits seemed fond of it and thrived on it."

Kudzu is of unquestionable value to wildlife in an indirect way. Removal for hay of annual soil improvement crops—lespedeza, cowpeas, and soybeans—will be unnecessary when hay needs are supplied by perennials such as kudzu. Thus wildlife foods will be left with the plant material that should be returned to the soil for the benefit of succeeding crops. Kudzu will influence farm wildlife—this is unquestionable—but just how and to what extent is now being determined.

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PROVIDING FOR WILDLIFE IN FARM PLANNING

By HOMER G. TOWNS [1] and HARVEY D. BURKHALTER [2]

To devote every parcel of land to its best and safest use is the goal of farm planning. An example from Louisiana demonstrates the method and discusses the results.

THE farm of J. A. Burgess at Bernice, La., is a typical farm operated by a typical farmer. Its planning and development illustrate the basic principles of correct land use. Mr. Burgess signed an agreement with the D'Arbonne Soil Conservation District on May 29, 1939; in December 1941, practically all obligations set forth in the agreement had been completed.

Before the agreement, there were on the farm approximately 62 acres of cultivated land, no meadow, 21 acres of native brushy pasture, 14 acres of woods pasture, and 11.5 acres of woods protected from grazing. Livestock consisted of 3 to 5 cows and calves, 1 to 5 hogs, and 3 mules. Winter feed produced was insufficient; all crop residues were consumed, and the pastures were in a much over-used condition. Because of grazing and burning and because there had been no selective cutting, the woods had been yielding only firewood and posts for home use, in spite of the fact that, with protection and proper cutting practices, they could provide all the wood products needed on the farm and in addition an estimated increment of $75 to $100 per year. At the time the farm was planned, so far as Mr. Burgess knew—and he knew his land well—there had never been more than 2 coveys of bobwhite quail on it at any one time.

In planning the farm, very little change was made in the general scheme of land use. The amount of land devoted to cash crops and to permanent pasture remained essentially the same. Three and one-half acres of meadow were added, and 20 acres of woods were protected from grazing. One and one-half acres of gullied, brushy, and rocky land were devoted to wildlife, and borders of sericea lespedeza were established between woods and cropland. The plan also called for construction of a one-half acre farm pond that will provide water for livestock and, if properly managed, all the fish the family can use. A system of crop rotation was established to include both summer and winter legumes; and 5 acres of steep, badly eroded cultivated land (class VII) were converted to pasture and woodlot. Pasture improvement practices included mowing, sodding, seeding, fertilizing, and contour ridging.

By 1941 Mr. Burgess was of the opinion that his per-acre crop yields had increased approximately 25 percent and that the carrying capacity of his pasture had more than doubled; he also produced 7 to 8 tons of hay whereas formerly he had produced none. Seventeen animal units of livestock are now supported, with sufficient pasture and supplemental feed for winter use. There are now 5 coveys of bobwhite quail on the farm. It is evident that these quail, as well as the small birds and mammals that are on the farm throughout the year, owe their existence in part to the fact that proper treatment of each parcel of land on the farm increases what is known by the biologists as "habitable edge," thus making every acre of land on the farm contribute its share to the welfare of wildlife. On the Burgess farm this habitable edge was increased from approximately 100 to 600 rods.

The average farmer does not need to reduce the production of cash crops to provide for wildlife; frequently he can provide habitable edges as a natural result of farm operations conducted in accordance with a sound soil and moisture conservation program. The job for the farm planner is to visualize, as did the farm planner for the Burgess farm, the opportunities that exist for using every parcel of land in accordance with its needs and capabilities.

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TEN YEARS OF PROTECTION

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The comparative abundance of woodland shrubs and wild flowers is no less striking than that of birds and seedling trees. Red elder, blackberry, raspberry, sassafras, and thornapple, which provide food and nesting cover along the margins of the protected woods, are absent or sparse across the fence. Also present in the protected woods, are such wild flowers as the large flowered trillium, Sweet William, bloodroot, spring beauty, Jack-in-the-pulpit, and hepatica. More delicate plants, as ground-nut, Dutchman's breeches, and large roundleaf orchid, are again making an appearance. Even the much-collected ginseng that

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WILDLIFE INCREASED BY EROSION CONTROL PRACTICES

By A. C. HAWBECKER [1] and R. M. BOND [2]

Substantial increases in wildlife have been observed repeatedly on farms where soil conservation measures have been put into effect. A painstaking count in California confirms the close relation between patterns of land use and wildlife numbers.

Basin-listed and planted in 1937, this field by 1941 supported a thrifty stand of young knobcone and Monterey pines.

Young mourning doves on their nest in one of the Monterey pines of the 4-year-old erosion-control planting shown in the other view.

WHAT happened on the Morse Ives farm, near Watsonville in Santa Cruz County, Calif., lends force to the statement that soil and wildlife conservation are interdependent, and that planting appropriate vegetation on eroded or otherwise unproductive lands will increase wildlife. In 1932, Mr. Ives observed that rapidly declining yield was rendering an upper field of 120 acres unprofitable for crop, and that soil washing from it was injuring a valuable lower field. Intensive cultivation had produced severe sheet erosion, the productivity of the farm was low, and the numbers and species of wildlife on it were few. That year he planted a few rows of trees, mostly Monterey pines, on the eroding field. In January 1937, after this planting had reached an appreciable size, the remainder of the 120 acres was basin listed and planted with trees and shrubs in cooperation with

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the Soil Conservation Service. This treatment was primarily to provide the eroding land with a cover of vegetation, but open spaces in the plantation, the species of plants, and their arrangement were planned to benefit wildlife, particularly quail. Survival was about 50 percent, and at the end of the third growing season there remained alive approximately 25,000 trees and shrubs. The important surviving species were Monterey and knobcone pines, Arizona cypress, mahogany sumac, laurel sumac, and ceanothus.

In March 1937, 2 months after the second planting, the California Division of Fish and Game released 7 quail on the farm. Some of the birds survived and bred, although food was exceedingly scarce and the only permanent cover was afforded by the few trees planted in 1932. The growth of annual seed-producing herbs and grasses, however, was better than in previous seasons, probably because of the basin listing. By the autumn of 1937 there was a covey of about 15 quail on the farm, most of which survived the winter. In May 1938 several mated pairs were observed and later young were seen. A census in the autumn of 1938 showed a population of approximately 40 birds. A year later, October 1939, 47 quail were counted—a small relative increase due probably to the low rainfall of the preceding winter, which adversely affected plant growth and may have curtailed the food supply.

In 1940 the Ives farm became Camp McQuaide, and roads and buildings were constructed in the plantings. Conditions were so radically altered that intensive study of the wildlife was discontinued. However, observations made in the spring and summer of 1940 showed that there had been an excellent quail hatch, and that autumn there were probably 80 to 100 quail on the area. Quail were also abundant in 1941, and 2 broods of newly hatched young were found in June. So far as known, all the quail were descendants of the original 7. There was some hunting in 1938 and 1939. Ground squirrels were reduced occasionally by gassing, but there was no predator control.

Because small birds in this part of California nest from early February to August, a complete census of breeding birds is impractical; but in late May and early June of 1940, Charles G. Sibley, a student assistant in biology, made a nesting census in 53 of the 120 acres planted. He found 62 nests of 8 species. Thirty-five nests were in trees—27 of the trees were Monterey pines. By 1941, the shrubs were also in use; a cursory survey in June showed many nests of willow goldfinches and several of Nuttall sparrows in the ceanothus.

That conditions favorable to one kind of wildlife usually are favorable to many is demonstrated by a comparison of the birds found on the Ives farm with those found on adjacent land in an eroded and barren condition. Twenty-six species of birds, 14 of which nested, were seen on the farm in 1940 and 1941. On the adjacent check area there were only 18 species of birds, 7 of which nested. As examples of changes that have occurred, pheasants, although rare outside became abundant on the planted area, whereas horned larks became less common because of the dense ground cover.

The importance of water to bird life even in this relatively humid part of California was demonstrated when the cooperator, in the spring of 1940, constructed a watering station at ground level in the midst of a planting of ceanothus when the shrubs were about 4 feet high and afforded fair cover. By midsummer the ground around the basin was littered with molted feathers, and pheasants and quail were making constant use of the shrubs as dusting and loafing cover. Several counts for short periods were made of the birds coming to this water. On June 7, 1940, observation was maintained from 9 a. m. to noon, and from 1:30 to 4 p. m. During these periods 358 birds of 11 species used the water for drinking or bathing. The most numerous were the house finch, 239 of them; the Lawrence goldfinch, 45 in number; and 19 Nuttall sparrows. A few weeks later, when the vegetation had become drier, many quail, pheasants, and meadowlarks also came to the water. A band-tailed pigeon used the water all summer. This water supply is now maintained by the Army, and the birds still use it eagerly.

TEN YEARS OF PROTECTION

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has long brought fancy prices on the drug market, has become established in several colonies in the last few years. Continued grazing has excluded or dwarfed these and other woodland plants across the fence.

Mr. Kibler is convinced that protection has increased the yield of maple sirup and the volume growth of timber; that it has stopped loss of trees from grazing injury; ensured reproduction of new trees to replace those removed; and that it has made the woods a more interesting place because animal as well as plant life is more abundant. Above these values, he realizes a glow of pride in having made a worth-while contribution to conservation in his community. He is the first cooperator in the Northeast Ohio Farm Forestry Area, and his farm and his woods are serving as a demonstration of wise management. The comparison with the grazed woods will not last long though, for his neighbor plans a fence, too.

WILDLIFE MANAGEMENT ON IRRIGATED FARMS

By H. P. PRATT [1] and W. S. LONG [2]

Farmers who must pay a high price for irrigated land obviously cannot afford to use it wastefully. Yet spoil banks along hundreds of miles of irrigation ditches are usually productive of little more than a crop of weeds. By proper treatment, however, these noxious plants can be largely eliminated, the banks stabilized, and in the same operation the relatively abundant wildlife of irrigated farmland can be profitably increased.

IN MANY parts of the United States homes for wildlife have been destroyed by draining of swamps, plowing of grasslands, cutting of forests, and by clean cultivation, but on irrigated lands of the West agricultural operations have often converted barren areas into suitable habitats for pheasants, quail, ducks, and other forms of wildlife. Such operations provide water—a critical factor in the survival of both man and wildlife in arid and semiarid regions. Excellent pheasant hunting exists in the irrigated sections of northern Colorado, central Utah, and southern Idaho, whereas ring-necks are almost nonexistent outside watered areas. The irrigated hay meadows of the Gunnison and San Luis Valleys, Colo., now are nesting grounds for many ducks. In early days, according to the people who first settled these valleys, only a few ducks nested along the streams, but after water was spread over the valley lands the ducks began to increase.

Most irrigated lands offer wildlife the essentials of food, cover, and water. Crop residues and waste grain that remain on the fields during the colder months provide winter food in abundance. Ditches furnish water during the summer season when it is most needed, and the banks, which usually are grown up with cover of various kinds, provide travel lanes to food, cover, and water. With conditions so nearly ideal, it might be thought that wildlife management is not needed on irrigated lands. Unfortunately this is not true, because in many localities land use practices impede soil and moisture conservation and are detrimental to crop production and to wildlife.

When man and his agriculture came to the West, many weed and insect pests that had plagued him in the East came with him. Irrigation ditches were ideal places for noxious weeds. In the campaign against weeds, burning became one of the common methods of control. Burning, however, destroys wildlife cover, hinders the establishment of perennial grasses and does not eliminate weeds. Occasionally, it destroys property and crops. On the other hand, the establishment of perennial vegetation along ditch banks replaces weeds, aids bank stabilization, and improves wildlife habitat. Desirable grasses and other plants, once established, should be protected permanently against burning and overgrazing. Some weed control may be necessary until the grasses are well established. Where conditions are suitable, dense, low-growing shrubs, such as sumac, rose, wild plum, and blackberry may be substituted for grasses. A low-growing tree of high wildlife value that may be so used is the Russian olive. Spoil banks along drainage ditches and waste areas between ditches and fences are best suited for woody plantings since care must be taken to prevent establishment of shrubs where they may spread into cultivated fields or interfere with ditch maintenance. A few fruit trees and berry bushes may be planted with the shrubs to provide an addition to the farm diet or to augment the farmer's cash income.

Another destructive practice in irrigated areas is the overgrazing of fields in winter. Horses and cattle often are turned into fields to graze on crop residue and are kept there most of the winter. Under such conditions, cover in odd corners and along the fence rows and ditches may be completely destroyed or so reduced that wildlife has little protection from predators and inclement weather. Likewise, serious damage to fields and crops may be caused through soil compaction; and the reduction of perennial grasses and shrubs increases noxious weeds and erosion hazards. Controlled grazing, on the other hand, does little harm and properly utilizes crop residues.

Where stock must be held on farm lands throughout the winter, planting of roses and other shrubs resistant to grazing, and fencing of key areas will improve conditions for wildlife. In many cases these areas also may be used as fruit and berry patches. The wildlife value of fenced areas is shown by winter counts of Gambel quail and ring-necked pheasants in two such areas near Grand Junction, Colo. Both were on

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irrigated farms where there was heavy winter use by livestock. In the first area there was an increase from 14 quail before fencing to 25 quail and 1 pheasant 8 months after fencing. In the second, which included a portion of a large wash, there were 24 quail and 1 pheasant 4 months before fencing, and 38 quail and 3 pheasants 8 months after fencing. Undoubtedly the increases were due to the favorable cover conditions resulting from the protection the fences afforded.

In most irrigated sections there are bodies of impounded water ranging in size from tiny ponds to large reservoirs. Siltation, grazing, complete drainage, and improper stocking with fish are among factors that prevent them from having a high wildlife value. Fenced areas at the upper ends of ponds aid in the establishment of grass and shrubs and thus prevent silt from entering the basin. Such protected spots are extensively used by birds and mammals. The fencing of ponds and elimination of shore-line grazing by livestock also allows a permanent cover of protective vegetation to develop on the banks and shore, decreases siltation, and provides a good wildlife habitat. With proper management, the pond itself can produce fish—an additional source of food and income for the farm family.

Thus irrigated farms, already contributing much to the welfare of western wildlife, can be made of even greater usefulness by simple practices beneficial to agriculture and contributing to sound land management.

WATER FOR WILDLIFE IN THE SOUTHWEST

By A. E. BORELL [1]

In the Southwest, good distribution of water means not only better livestock but also more wildlife. The country can use more of both crops.

THE problem of increasing wildlife populations in the Southwest often centers upon the supply of water. Food and cover are insufficient in many places; but on the other hand it is true that there are thousands of acres of potential wildlife habitats that cannot be fully utilized because of the absence of water. It is probable that by doubling the number of permanent watering places in arid areas the wildlife population could be doubled. Nor would this be an expensive undertaking, because in many instances it would mean no more than a modification of water developments made for other purposes.

The common set-up for livestock water—and there are thousands of them in the Southwest—is a windmill, a large circular metal storage tank, and a metal or concrete watering trough. Water in the tank and trough stands at 3 or more inches below the rim and is controlled by a drain that carries away the surplus water, often into a gravel bed. As a result, water is not safely available to wildlife and becomes a death trap to those animals that try to use it. Many birds and mammals are needlessly destroyed and their carcasses pollute the water. Occasionally, the tanks are covered and this prevents even the insect-destroying bats from getting water.

Any one of several simple inexpensive modifications of tanks and troughs will make water available to wildlife and prevent pollution. With tanks the simplest procedure is merely to throw a plank into the water, but this is only temporary because sooner or later someone will remove the plank. The most satisfactory device is a heavy wooden float that is securely anchored by a plank hinged to it and to the rim of the tank. Hinging permits the float to ride the water level with its rise and fall. In lieu of a float, heavy hog wire of small mesh may be welded to the bottom and rim of the tank to provide a gently sloping ramp. If the wire is painted with tar or asphalt, the action of rust will be retarded. Concrete troughs should have steps built into one end. These steps permit birds to obtain water regardless of its level, and also aid the escape of livestock that accidentally get into the trough. Metal troughs may be provided with a wooden float or a wire ramp.

These devises make water available and safe to bats and adult birds, but young birds and nonflying mammals are not benefited. To make water accessible to all forms of wildlife and especially to young quail, it is necessary to construct a small basin that is almost flush with the surface of the ground. Such a basin should draw water from the storage tank and may be controlled by a float or drip pipe. It should be protected from livestock by a fence that will permit establishment of cover plants.

The water in earthen stock ponds is much used by wildlife, but if such ponds are unfenced, livestock may so concentrate as to keep the shores barren of vegetation. At such sites food and cover are not close at

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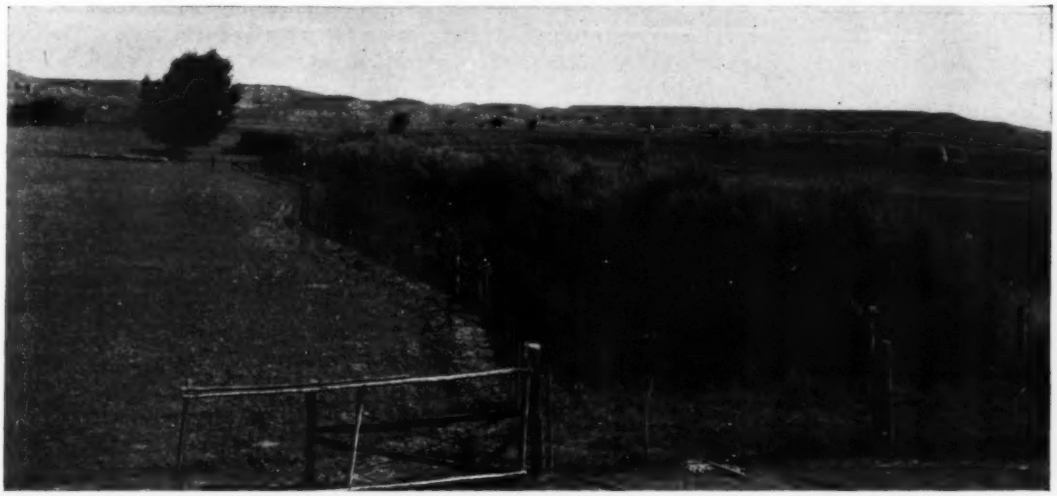
WINDBREAKS AND THEIR VALUE TO WILDLIFE

By ADRIAN C. FOX [1]

In a broad belt from the Canadian border to central Texas, windbreaks have been set against the strong winds of the Great Plains. In a virtually treeless land these rows of trees and shrubs shelter man and his livestock, check the drifting soil, and provide a haven for wildlife.



Three years' growth of a newly established Wyoming windbreak, planted on the contour, has produced a thick, vigorous stand of trees bordered by fruit-producing shrubs. Here wildlife finds both food and shelter.

LIKE many other States of the Northern Great Plains, North Dakota was originally a sweeping expanse of undulating grass-covered prairie. Trees were confined to the fringes of small lakes and slow-moving streams. Early settlers plowed the grassy plains and cut the sparse woods, and at first wildlife profited—the prairie chicken thrived on waste grains in the cultivated fields that dotted the plains where nesting cover was still preserved. Then came intensified farming and increased livestock, and the prairie chicken found nesting sites and booming grounds confined to weedy fence rows and plowed fields. Other wildlife also felt the effect of the changes in land use.

Homesteaders brought to the Plains from the Eastern States or the countries of northern Europe an inborn love of their tree-covered homelands. This love of trees, together with the desire to obtain protection from hot summer winds and winter blizzards, induced the pioneers to plant windbreaks. Private initiative was stimulated by Government aid through the Timber Culture Act of 1873.

[1] Assistant biologist, Northern Great Plains Region, Soil Conservation Service, Mandan, N. Dak.

Recent agricultural programs recommend trees for appropriate sites because they reduce wind velocity and wind erosion. Windbreaks make farm homes more habitable and protect feedlots and livestock from cold winter winds. Shrub buffers, gully, riverbank, and lake-shore plantings supplement the windbreaks. Recently snow-hedge plantings have been established along farm lanes and roads leading to rural schools, churches, and mail boxes in order to protect the roads from drifting snow. The snow hedges, together with other types of tree plantings, serve as wildlife havens.

Pheasants and Hungarian partridges range over the entire farm during the spring, summer, and fall months when they use field borders, fence rows, and the edges of shrub and grass buffers as travel lanes. When the snow deepens and the weather becomes more severe, the birds resort to the leeward sides of windbreaks and other sheltered areas where food and cover more nearly fulfill their needs. Thus, in designing and planting windbreaks, an effort is being made to compensate for wildlife habitat deficiencies.

Frequently the survival of a wild bird depends upon the amount and availability of winter food, just as the

amount of forage on pastures and ranges during any critical period determines the carrying capacity for livestock. With some species, however, as with the ring-necked pheasant, shelter requirements may be so closely associated with food requirements that without shelter even well-fed birds often perish from cold and suffocation. As windbreaks near maturity, the dense foliage of conifers, brush piles, undergrowth, and hollow trees provide a year-round shelter for many birds, as bluebirds, sparrows, woodpeckers, owls, hawks, waxwings, and chickadees. Raccoons, woodchucks, skunks, squirrels, and foxes likewise utilize this shelter and under proper management can contribute to the sport of hunting and trapping and to the economic welfare of the farm.

Wildlife foods such as fruits, berries, tree seeds, mast, and buds are furnished by many species of woody plants used in windbreak plantings. The native wolfberry, often used in fence rows and in the underplanting of taller trees provides berries which are available from August to late spring. They are a favorite winter food of pheasants, prairie chicken, and sharp-tailed grouse. Grape and Virginia creeper planted in fence rows on the leeward side of windbreaks provide food and excellent nesting cover where, during hot, late summer days, game birds seek shady dusting spots. The fruit of Virginia creeper, available until late winter, is sought by ruffed grouse, prairie chicken, and many songbirds. The Russian olive, an introduced exotic, much used in many types of tree plantings, offers fruit which often persists until late spring, and is eaten by Bohemian and cedar waxwings, pheasants, and native grouse.

Dogwood, gooseberry, currant, rose and other shade-tolerant, native species used in under-planting windbreaks provide an understory which makes excellent nesting cover for ground-nesting birds. The rose hips, or fruits, persistent the year 'round, are fed upon by the pheasant, sharp-tailed grouse, prairie chicken (now called pinnated grouse), ruffed grouse, and many songbirds. There is some evidence that the large, hard rose seeds may, in the absence of sand, serve as grit for wintering game birds. Many other trees, shrubs, and vines including cedar, spruce, box-elder, ash, serviceberry, hawthorn, silverberry, cottonwood, plum, chokecherry, sandcherry, oak, sumac, buffalo berry, willows, and honeysuckle are much used in windbreaks and other types of woody plantings, and each of them contribute something in the form of food, shelter, or nesting cover toward the improvement of Northern Great Plains farms as suitable environments for desirable wildlife.

PLANTING SPOIL BANKS AND DITCHES

By R. E. CULBERTSON [1] and RICHARD M. MAY [2]

REVEGETATION of drainage ditches and spoil banks by direct seeding produces a vegetal cover that adequately protects the slopes and berms without impeding water flow, and yet is sufficiently aggressive to exclude undesirable plants. In addition valuable cover for wildlife is thus produced and the ditches are more easily maintained than when covered with wild plants that invade unmanaged sites.

Experience in the Northeast indicates that ordinarily good cover may be established by seeding in early spring or late summer. All necessary tillage operations should be performed at right angles to the slope; mulch should not be applied unless some provision is made for holding it in place with tobacco cloth, wire netting, or similar material. Critical areas may be sodded. In the Northeast, creeping red fescue, creeping bent, reed canary grass, ryegrass, tall oatgrass, and orchard grass have proved generally effective. Weeping lovegrass has been outstanding in Delaware and Maryland. Companion crops such as oats or wheat may be used, and ryegrass included in the mixture provides quick protection. Protection from livestock is necessary, especially until the plants are established.

Spoil banks in wooded areas usually are not leveled. Such banks afford sites particularly useful to wildlife. Depending on the site and climate, direct seeding of woodland spoil banks should include reed canary grass, sericea lespedeza, and bush lespedeza. Here also it may be desirable to plant seedlings. Useful species are coralberry, silky cornel, arrowwood, hazelnut, bayberry, blueberry, huckleberries, Virginia creeper, honeysuckle, and trailing raspberries. An ideal planting plan includes a narrow band of rushes *(Juncus)* at the toe of the ditch slope, a grass such as weeping lovegrass on the slope, and sericea lespedeza or a suitable shrub on the 10- to 15-foot berm.

With such treatment croplands adjoining ditches become accessible to a larger number of farm wildlife species, and openings through woodlands are transformed into more widely usable wildlife habitats.

[1] Associate agrostologist, regional nursery division, Northeastern Region, Soil Conservation Service, Upper Darby, Pa.

[2] Assistant area conservationist, Northeastern Region, Soil Conservation Service, Catonsville, Md.

MORE RUFFED GROUSE FROM WOODLAND MANAGEMENT

By FRANK C. EDMINSTER [1]

Lumber, posts, fuelwood, ties—these are not all that a northern woodland can produce. If management is properly planned, a goodly supply of ruffed grouse can be assured. Significantly, the best management methods for wood products, game bird, and soil conservation, are identical.

IT IS now a recognized fact that management of the farm woods should be based on a broader interest than production of wood products—soil preservation and watershed protection are vitally important. Likewise, where grouse are indigenous, the needs of this valuable game bird should be met.

The whole ecology of the bird must be considered, particularly its food and shelter requirements; these must be translated into simple practices that will fit into general woodland management. The ruffed grouse is essentially a woodland bird and its presence depends in large part on how man handles the woods in which it lives. Hence, management of grouse is of necessity a form of woodland management. Some of the usual woodland management practices are beneficial to grouse while others may be definitely harmful. By emphasizing the former and avoiding the latter, good management of the farm woods provides a habitat suitable for grouse.

Good grouse habitat is an uneven-aged stand, largely second growth, composed of both hardwood and coniferous types, well interspersed with shrubby margins, glades, and open edges. Hemlock, spruces, and soft pines afford the best cover, especially when in clumps. Oaks, cherries, and beech provide nuts and fruit when allowed plenty of sunlight; and birches, poplars, cherries, and hophornbeam are of particular value for their palatable buds.

The first requirement of both trees and birds is elimination of fire and domestic livestock. In some places this protection alone will bring considerable improvement, but the major opportunities for increasing grouse populations lie in the cutting operations, whether improvement cuttings or harvest. Distribution of age groups of trees requires a selective cutting system, not a clear-cutting job. Second-growth woodland will result if all crop trees are removed as they reach full size and if only the few trees needed for seed production are left. The distribution of types may be influenced by selective cutting according to species, favoring in one place the kinds that make a good conifer stand, and in other places those that make a good hardwood stand. In all cutting work, attention should be given to the preservation of those varieties of woody plants most valuable for grouse shelter and food.

Additional shrubby cover may be provided by keeping woodland roads brushed out, and by using the group-selection system of cutting to form numerous little glades. Shrub borders along edges where woods adjoin open fields may be developed by cutting all trees for a distance of 25 to 50 feet into the woods. Species of shrubs, vines, and small trees to be favored

(*Continued on p. 262*)

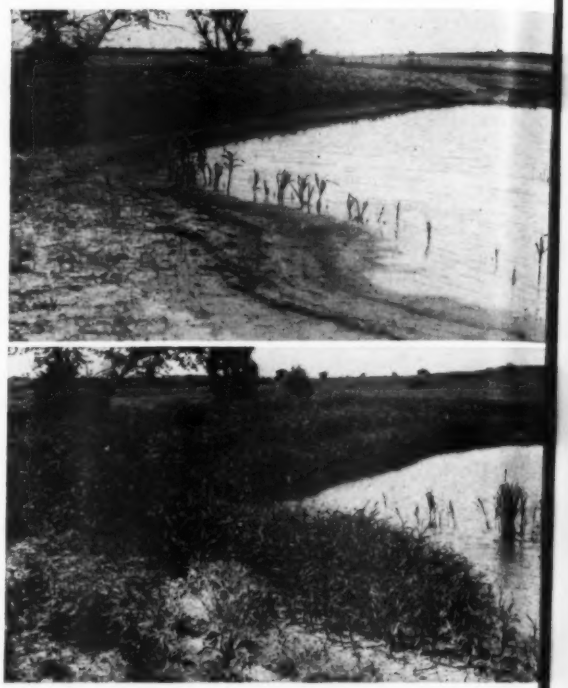
[1] Chief, regional biology division, Northeastern Region, Soil Conservation Service, Upper Darby, Pa.

A STORY OF POND PROTECTION

By STANLEY W. AUSTIN [1]

April 22, 1941.—On the earth fill of H. E. Talley's new farm pond in the Osage County Soil Conservation District, Kansas, a row of river bulrush was planted April 22, 1941, to protect the dam from wave action. The plants were hauled from a marsh, lifted with a spade, and transported in pails of water to keep the roots from drying. Most of the top growth was cut off and the roots, spaced 6 feet apart, were pushed into the mud in 2 or 3 inches of water. (Three-square rush, giant bulrush, and giant bur reed are also being used for this purpose.)

September 25, 1941.—Five months later the plants have spread from underground runners and developed a mat of vegetation at the water's edge. Because river bulrush does not grow in deep water it will remain confined to a narrow zone at the edge of the pond. This pond is in a hay meadow and water is piped to a tank in the pasture below; for, to remain useful, such plantings must be fenced or otherwise protected from livestock. In addition to protecting the dam, the vegetation has created a home for muskrats, redwing blackbirds, and other wildlife.



[1] Assistant soil conservationist, Southern Great Plains Region, Soil Conservation Service, Osage City, Kans.

WATER FOR WILDLIFE IN THE SOUTHWEST

(Continued from p. 258)

hand, and birds and mammals must expose themselves to enemies in order to obtain water. This harmful feature will be removed if the pond and a desilting area above it are fenced. The water may then be made available to livestock by piping it to a trough below the pond or by placing water gaps in the fence. A desilting area should always be fenced even if the pond can not be. Such an area not only provides cover for wildlife but also prolongs the life of the pond through reduction of siltation.

The springs of the Southwest are never large, hence their scanty supply of water must be carefully husbanded. This is best done by fencing the spring and constructing a trough or a catchment basin from which livestock may drink. Fencing will prevent stock from trampling the spring; the increased vegetation will protect the spring from siltation and will provide cover for wildlife.

Although water is a limiting factor in the distribution and abundance of wildlife in the semiarid regions, there are many inexpensive ways in which wildlife may be provided with more water. All of these are pointed toward conserving water, and preventing siltation and pollution—thus they are of equal value to agriculture and contribute to good land use.

MORE RUFFED GROUSE FROM WOODLAND MANAGEMENT

(Continued from p. 261)

in such places are hawthorns, apples, brambles, dogwoods, viburnums, sumacs, grapes, blueberries, greenbriers, bayberry, cherries, roses, and hazelnut. In the woodland understory, the mountain laurel, wintergreen, partridge berry, viburnums, and the ferns are especially useful, while along woodland roads valuable foods may be available from the sedges, clovers, and strawberries.

Through good woodland management, and by encouraging the plants that make good grouse habitat and provide needed cover types in a well interspersed pattern, larger populations may be had of that prince of all birds of the northern forests, the ruffed grouse.

STERILE STREAMS TAKE ON NEW LIFE

By HOWARD C. HASS [1]

Banks of streams are easily eroded, and have always been critical places as far as land use is concerned. They cannot be cultivated, nor should they be grazed except rarely. They can be used, however, to produce wildlife, if properly managed.

IN THE rugged terrain of La Crosse County, Wis., torrential storms cause serious damage to bottomland fields and pastures if no measures are taken to control erosion and flood waters. First attempts at streambank control, by use of brush and rock dams, piling, riprap and similar structures, did not give sufficient protection. The brush and piling rotted, torrents carried away the rock, and channel straightening increased the gradient and destructive power of the stream.

On a few farms, however, the streams were fenced, except at places where stock could be watered. Willows were placed on the outside of curves; brush and rock dams were constructed; clumps of shrubs and conifers were planted; and black locust was established along the edges for future fence lines. Streambank control was thus improved.

Other farmers experimented still further. To eliminate expense and labor they merely fenced the streams and left them in the hands of the healing forces of nature. Thus livestock could not reach the streambanks, and in a year or two heavy sod and volunteer willow growth protected the raw banks except at the more critical points. These points were then treated with brush and rock. Besides saving labor and material costs, these farmers attained their goal of streambank protection with the tools at their disposal.

Wildlife was not slow to take advantage of the cover provided along the protected streams. As one farmer commented: "Hunters are getting pheasants and rabbits today out of cover that just wasn't there a couple of years ago." Another, owning about 80 rods of protected stream, made this remark: "My part of the stream had more trout and was fished more this year than ever before."

Not all streambank problems in La Crosse County are solved, and only a small number of farmers having such problems have attempted any treatment. There is little doubt, however, that more of them will soon learn the advantages of treating streambanks as part of a program aimed at complete watershed protection against soil erosion—then raw banks will disappear and the sterile streams will take on new life. It is significant that the supervisors of the La Crosse County Soil Conservation District have adopted the policy that protection from grazing is a prerequisite to getting help from technicians or obtaining labor assigned to the district.

[1] Assistant soil conservationist, Upper Mississippi Region, Soil Conservation Service, Sparta, Wis.

BARBED WIRE CONSERVES SOIL AND WILDLIFE

By PHILIP F. ALLAN [1] and PALMER R. SIME [2]

THE most obvious factor that limits many species of wildlife in the Great Plains is the unsuitable interspersion of cover in relation to food. Often there may be a total absence of cover. The vast flocks of mobile seed-eating birds indicate that food supplies, particularly waste grains and the seeds of weeds and grasses, are abundant. However, more sedentary species such as the scaled quail, are hard put to reach food at all seasons, since the food plants generally lack the qualities necessary for shelter. The use by quail of a bare barbed-wire fence is a plain indication of cover deficiencies; it is a common sight to see a covey of these birds running beneath the bottom wire and dodging posts only to return to the meager protection of the wire.

The barbed-wire fence, used to enclose small areas, can quickly remedy cover deficiencies and at the same time serve as a soil-conservation measure. In a single year, weather favoring, the protected vegetation becomes adequate to serve both purposes. Rangeland ordinarily has many small spots that need erosion control, yet which contribute little food for livestock, Box canyons, gully heads, rocky knolls, escarpments,

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[2] Associate Biologist, Southern Great Plains Region, Soil Conservation Service, Lubbock, Tex.

sand blows, and galled spots are the principal places that should be given protection. That the fence is of prime importance in protecting such sites has been shown by its use on 91 farms and ranches in the Texas Panhandle during the past year—here can be seen a truly surprising recovery of the vegetation within fenced areas. Weeds and grasses grew to an average height of 2 feet, and the density of this vegetation was suffcient to control erosion despite the heavy rains of 1941.

A recent check of 10 fenced areas near Memphis, Tex., revealed some interesting data. The areas varied in size from 1 to 20 acres and were principally on sand blows and galled spots. The vegetation, noticeably heavier in these enclosures than in adjoining lands, was predominantly sand dropseed (*Sporobolus cryptandrus*), with sunflower (*Helianthus annuus*), Texas croton (*Croton texensis*), ragweed (*Ambrosia* sp.), pigweed (*Amaranthus* sp.), three-awn (*Aristida* sp.), and buffalo bur (*Solanum rostratum*), which are locally abundant. Here and there were scattered mesquites (*Prosopis chilensis*) and Texas buckthorn (*Condalia obtusifolia*). An example of the effectiveness of the fenced area for erosion control is particularly evident on one 12-foot gully where sufficient growth of grasses and weeds has developed during the past year to halt further cutting.

A limited survey of wildlife using these areas showed that 5 of the 10 were headquarters for conveys of bobwhite and scaled quail. One covey of 27 bobwhites was flushed, and many dust baths and roosts were found. Other wildlife seen, or evidence of wildlife using the enclosures, showed clearly that they serve as feeding sites for mourning doves, den sites for skunks, and rest spots for many small birds.

DEERWEED

By R. M. BOND [1]

THROUGH most of western and southern California the native deerweed or broom deervetch (*Lotus scoparius*) plays an important, though generally unnoticed, role in preventing erosion by rapidly occupying road fills and cuts, eroded spots, loose sand, and areas of thin soil.

The plant is a perennial legume, short-lived and slightly woody at the base. The many stems that ascend from the crown to a height of from 1 to 4 feet bear numerous red and yellow pea-like flowers in spring and early summer. By autumn the flowers and leaves have fallen to make a good ground litter, and the bare green stems assume a broom-like appearance. The small seeds, much relished by quail and other wildlife, mature and drop during summer and autumn; and the plant itself is eaten by deer, goats, sheep, and horses, but cattle seldom use it.

Although somewhat difficult to cut because it is tough and wiry, field trials in California show that deerweed is a good erosion-control plant when used as a mulch for galled and rilled areas, particularly if it is applied when bearing seed. It has an advantage over many other "weeds" that will grow on similar sites, in that it offers little competition to more desirable plants, and dies out as they replace it, after having prepared and enriched the soil for its successors. Further tests are being made to prove its value.

[1] Chief, regional biology division, Pacific Southwest Region, Soil Conservation Service, Berkeley, Calif.

WILDLIFE LAND

Soil conservation surveys, from which classes of land according to use capability have been developed in several hundred localities widely distributed over the country, reveal that about 2½ percent of all land in farms and ranches is unsuited for cultivated crops, hay, pasture, or woodland, because of its physical character. Based on this percentage, about 25,000,000 acres are classed as agricultural land that is well suited to production of wildlife, especially since the individual tracts occur in association with good land.

In addition, there are many millions of acres that cannot be farmed because of their location or position. This includes land in fence rows, railroad embankments, farm road rights-of-way, small corners in crop fields, and streambanks. For example, there are 2 million miles of streams on agricultural land in the United States, as estimated from representative surveys made by the Geological Survey and the Soil Conservation Service. This amounts to about 6 million acres of streambanks, if we consider 12 feet [1] on each side of the stream as unfit for farming. On the basis of census figures, it is estimated that there are in addition nearly a million acres of wildlife land along the banks of drainage and irrigation ditches.

The total amount of land that is suited for wildlife production only—because it is unsuited to any other kind of crop—is not known. On the basis of the above figures, it amounts to 33 million acres on farms and ranches alone. [2] Conservative as this is, the wildlife lands of agriculture amount to an acreage greater than that of all the land in the State of New York.

[1] The figure actually should be larger than 12 feet. A very conservative width has been chosen in order to avoid any possible overlapping of figures in the first paragraph.

[2] These estimates are included in the figures presented in the Report of the Chief of the Soil Conservation Service for 1941.

U. S. GOVERNMENT PRINTING OFFICE: 1942

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Field offices should submit requests on Form SCS-37, in accordance with instructions on the reverse side of the form. Others should address the office of issue.

Soil Conservation Service

Hydrologic Studies at the Coon Creek Demonstration Project, SCS-Wis-1, Coon Valley, Wisconsin: Compilation of Rainfall, Run-off, and Soil Loss from the Little La Crosse River and Coon Creek Watersheds 1934-40. SCS-TP-46. Soil Conservation Service with the cooperation of the U. S. Geological Survey, February 1942. Processed.[1]

Hydrologic Studies at the South Fork Palouse River Demonstration Project, SCS-Wash-1, Pullman, Washington: Compilation of Rainfall, Run-off, and Soil Loss from the South Fork Palouse River, Fourmile Creek and Missouri Flat Creek 1934-40. SCS-TP-47. Soil Conservation Service with the cooperation of the U. S. Geological Survey. February 1942. Processed.[1]

Increased Forage: The Key to Wise Wartime Livestock Production. Regional Bulletin No. 77, Range Management Series No. 3. Regional Office, Soil Conservation Service, Albuquerque, N. Mex. January 1942. mm.[1]

List of Commercial Sources of Grass and Legume Seed adapted to the Northern Great Plains Region. Regional Office, Soil Conservation Service, Lincoln, Nebr. February 1942. mm. (Prepared solely for official use by the Soil Conservation Service—not available for distribution.)

Revegetation of Meadows, Pastures, Ranges. Regional Office, Soil Conservation Service, Lincoln, Nebr. January 1942. mm.[1]

Small Farmstead Water Developments in the Southwest. Regional Bulletin No. 76, Engineering Series No. 5. Regional Office, Soil Conservation Service, Albuquerque, N. Mex. December 1941. mm.[1]

Snow Surveys and Irrigation Water Forecasts for Columbia Basin as of February 1, 1942. Division of Irrigation, Soil Conservation Service, Boise, Idaho, with the cooperation of other Federal bureaus, State Department, and local organizations. February 1942. mm.

Snow Surveys and Irrigation Water Forecasts for Oregon as of February 1, 1942, Division of Irrigation, Soil Conservation Service, with the cooperation of the Medford Branch, the Oregon Agricultural Experiment Station, the Oregon State Engineer, and other Federal, State and local cooperators. February 1942. mm.

Office of Information
U. S. Department of Agriculture

Birdsfoot Trefoil and Big Trefoil. Circular No. 625. Bureau of Plant Industry. November 1941. 5¢[2]

Erosion and Related Land Use Conditions on the Box Elder Creek Project, Nebraska. Erosion Survey No. 22. Soil Conservation Service. September 1941. 20¢[2]

Watch Your Step: Farm Safety for National Defense. Miscellaneous Publication No. 481. U. S. Department of Agriculture in cooperation with the Committee on Agricultural Safety, Federal Interdepartmental Safety Council. 1942.

Miscellaneous Federal Bulletins

After the War—Full Employment: Post-War Planning. National Resources Planning Board. January 1942.

Pillars of Plenty. FCI-Information 21. Federal Crop Insurance Corporation, U. S. Department of Agriculture, Washington, D. C. October 1941.

Price Administration, Priorities, and Conservation of Supplies Affecting Agriculture in the United States in 1917-18. Agricultural History Series No. 3. Bureau of Agricultural Economics, U. S. Department of Agriculture. November 1941. Processed.

A Selected Bibliography on the Economics of Forestry in the United States. Forest Service, U. S. Department of Agriculture, Washington, D. C. October 1941. mm.

Soybeans in Brief: A War Crop for Delta Farmers. Bureau of Agricultural Economics, U. S. Department of Agriculture with the cooperation of the Mississippi Agricultural Extension Service and Experiment Station. January 1942. mm.

Suggested State and Regional Distribution of Revised Goals and Expected Production for 1942. U. S. Department of Agriculture, Washington, D. C. January 1942. mm.

Summaries From Farm-Business Analysis Studies in the United States, 1907-39. FM-26. Bureau of Agricultural Economics, U. S. Department of Agriculture. December 1941. Processed.

Miscellaneous State Bulletins

Crotalaria for Forage. Bulletin 361. Agricultural Experiment Station, University of Florida, Gainesville, Fla. with the cooperation of the Bureau of Plant Industry, U. S. Department of Agriculture. August 1941.

Diversion Dikes and Channels for Saving Soil. Circular 434. Agricultural Extension Service, University of Missouri, Columbia, Mo. September 1941.

Economic Considerations in Planning for Soil Conservation on Tobacco-Combination Farms: Scantic River Watershed, Connecticut. Storrs Agriculture Experiment Station, Storrs, Conn., with the cooperation of the Soil Conservation Service and the Bureau of Agricultural Economics, U. S. Department of Agriculture. March 1941. mm.

An Economic Study of the Organization and Management of Beef Cattle and Other Types of Farms in Russell County. Technical Bulletin 71. Virginia Agricultural Experiment Station, Virginia Polytechnic Institute, Blacksburg, Va. with the cooperation of the Bureau of Agricultural Economics, U. S. Department of Agriculture. July 1941.

The Effect of Green-Manure Crops on Certain Properties of Berks Silt Loam. Technical Bulletin 73. Virginia Agricultural Experiment Station, Virginia Polytechnic Institute, Blacksburg, Va. September 1941.

Effects of Slope, Character of Soil, Rainfall, and Cropping Treatments on Erosion Losses from Dunmore Silt Loam. Technical Bulletin 72. Virginia Agricultural Experiment Station, Virginia Polytechnic Institute, Blacksburg, Va. August 1941.

Farm Drainage in Ten Easy Lessons. Extension Bulletin No. 269. Extension Service, Purdue University, Lafayette, Indiana, with the cooperation of the Soil Conservation Service, U. S. Department of Agriculture. July 1941.

The Missouri Soil Saving Dam: Low-Cost Structure for Use in Farm Plans for Water Management. Bulletin 434. Agricultural Experiment Station, University of Missouri, Columbia, Mo. October 1941.

The Soil Conservation District: A Legal Organization for Solving Farm Problems. Bulletin 373-A. Extension Service, Colorado State College. Fort Collins, Colo. July 1941.

Water Management for the Farm: Conserving Soil and Water for Efficient Production of Crops and Livestock. Circular 433. Extension Service, University of Missouri, Columbia, Mo. August 1941.

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[2] From Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.

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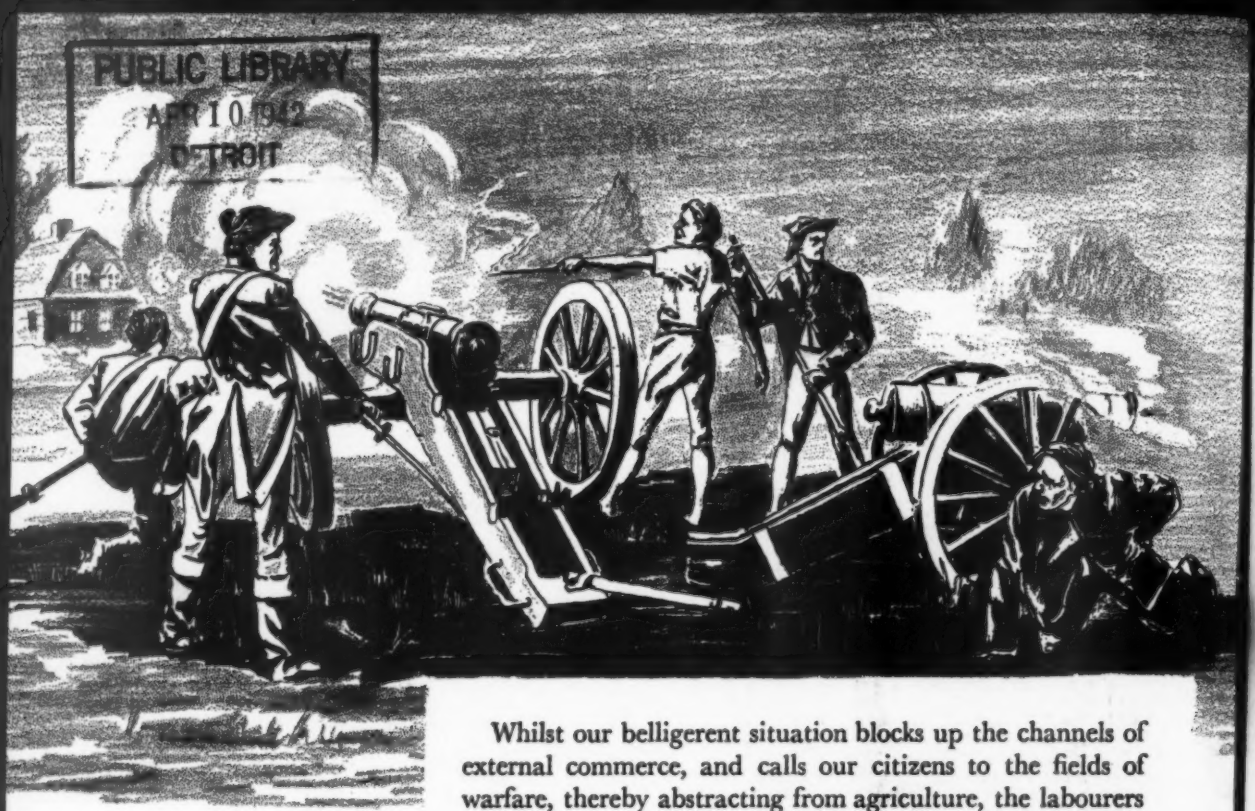
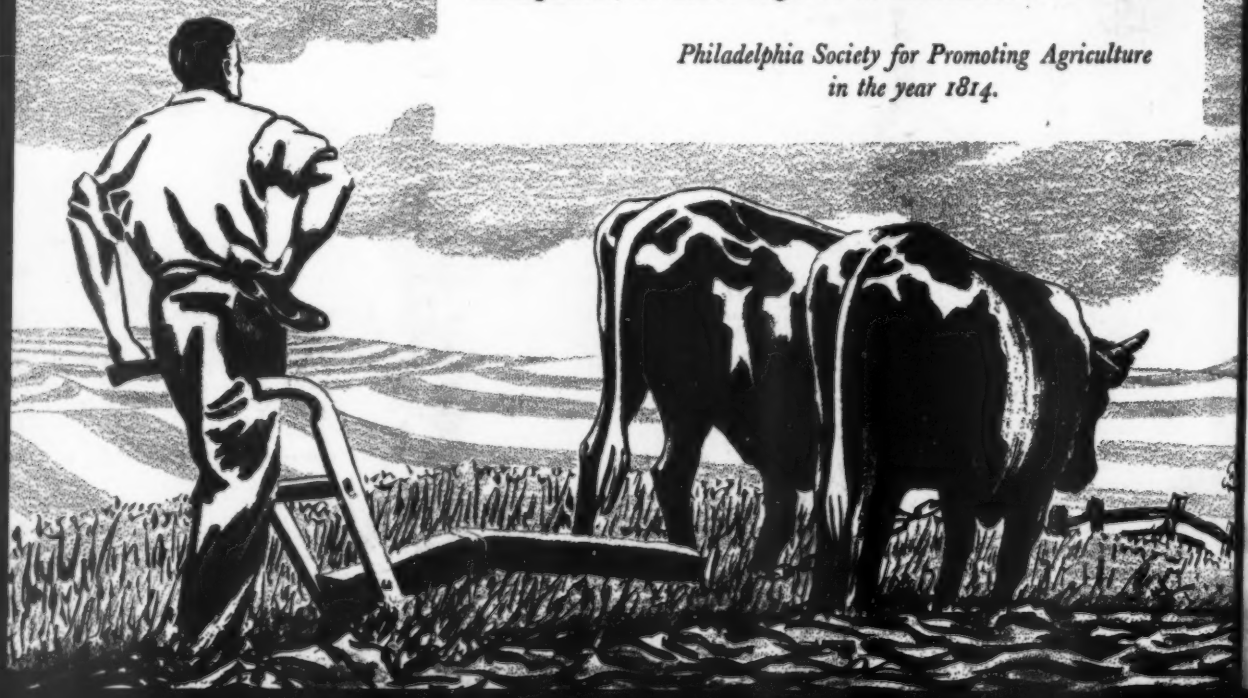


Whilst our belligerent situation blocks up the channels of external commerce, and calls our citizens to the fields of warfare, thereby abstracting from agriculture, the labourers it demands; it is the more necessary to know how to use the number spared to us, with the greatest economy and advantage. In such case we must endeavor to raise the greatest product, from the more limited surface to which our capabilities, as to labour and means, reduce us. That this can be done, in no small degree, by superior attention and management, no doubt ought to be entertained....

Philadelphia Society for Promoting Agriculture in the year 1814.